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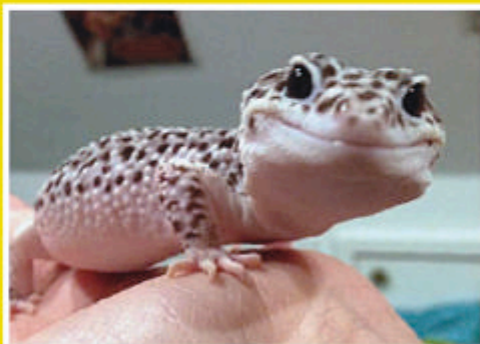
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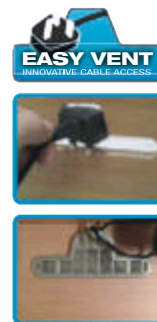
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July 2015.
Welcome



At veterinary school, they keep hammering into you the lesson that 'common things are common' when it comes to the conditions that you will encounter. And just as vets in general practice see various recurrent issues with dogs and cats, so it's now clear that the same applies in exotic practice. This perhaps wasn't so evident in the past, because cases involving reptiles were more spread out, but as owners increasingly seek to use exotic vets, so the situation is now much clearer.

As Dr Tariq Abou-Zahr explains in this issue, one of the most common conditions that he sees are snakes with burns. Sadly, in most instances, these are largely preventable, if only owners realised that snakes do not appear to sense the fact that they are being burnt.

Perhaps this is something that manufacturers could help to address, when designing product labelling, pointing out the danger and the necessity to use thermostats with heating products on safety grounds? The importance of screening lights safely, in such a way that arboreal snakes or lizards are prevented from gaining access to them is important too.

Are there fundamental changes to the designs of vivariums that might help as well, in terms of how heat sources are located here? It would be good to hear your thoughts on this important issue, so do email me at the address below.

There is no doubt that husbandry and health issues in the case of reptiles are often more complex than they may first appear though, as Tariq explains, when it comes to the use of sand as a substrate. It is a debate that divides opinion, but exotic vets are in an ideal position to delve deeper into this issue than individual owners, simply because they are seeing more cases.

The history of each individual animal not only helps to pinpoint the problem and assist its treatment, but is also now serving to build up a general databank of information. Using this, it is then possible to extrapolate as to which individuals are likely to be most susceptible to sand impaction, and why.

The same applies in the cases of snake mites, which, contrary to their name, can be seen on lizards too. More cases are seemingly the result of mites being spread inadvertently through bedding. It's something all of us need to be aware of, so as to break the cycle of infection.

David Alderton

David Alderton, Editor.
Email: prk.ed@kelsey.co.uk

David has extensive practical experience with this group of creatures, extending back over 40 years. He has written and broadcast widely about their care and biology, and his website can be found at www.petinfoclub.com

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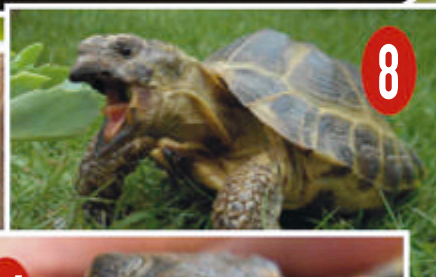
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SAVE UP TO 50%

New turtles arrive at London Zoo



A photo of the new enclosure. Photo © Ben Tapley/ZSL.

Zookeepers at ZSL London Zoo have embraced their artistic sides and designed a brand new exhibit for critically endangered Annam leaf turtles (*Mauremys annamensis*) that is worthy of any Hollywood film set.

Designed to replicate a restaurant kitchen, with the turtle pool resembling a kitchen sink, a 'bubbling' soup pot and woks hanging on the wall, the inventive set-design actually paints a very sombre picture.

Originating from a small area of central Vietnam, Annam leaf turtles are considered a tasty delicacy, and due to severe over-hunting for the restaurant trade and habitat

loss, the species is now classified as critically endangered by the IUCN and under a very real threat of extinction.

Reaching up to 30cm (12in) in length, these turtles have striking striped necks and faces. The beautiful creatures stand out in their kitchen-themed enclosure, and keepers hope the glaring juxtaposition will hit a chord with zoo visitors.

Team leader of the Reptile House at ZSL London Zoo, Ben Tapley explains: "We've gone to town on the new Annam leaf turtle exhibit here at ZSL London Zoo, as we want our visitors to really understand the threats facing these animals.



One of the Annam leaf turtle at ZSL London. Photo © Ben Tapley/ZSL.

"Providing a great habitat for these beautiful turtles, with water for them to swim in and a secluded nesting area hidden behind a carefully positioned wok, the creative exhibit tells a serious story.

"It has been estimated that more than ten million turtles are being traded for food, traditional medicine and the pet trade each year within Asia. Breeding programmes and zoo populations like ours here at ZSL London Zoo, are becoming increasingly important in guaranteeing the existence of these animals for the future."

Visitors to ZSL London Zoo can see the Annam leaf turtles and hundreds of other amphibian and reptile species in the Reptile House, and learn more about ZSL's charitable work to protect endangered species around the world. Book online now at www.zsl.org

Turtle Week



In order to help to raise awareness and knowledge about turtles worldwide, industry leader Zoo Med Laboratories and dedicated conservationists in the Turtle and Tortoise Preservation Group (TTPG) teamed up for the third year in a row to promote 'Turtle Week'.

This event led up to the annual World Turtle Day celebration on May 23rd, and was filled with photos, information, and activities about the world's turtles and tortoises.

Since their initial collaboration in 2013, Zoo Med and TTPG have supplied over 600 classrooms with special World Turtle Day lesson packets to help educate pupils and inspire the next generation of ambitious leaders about the significance of these ancient creatures and the importance of protecting them and their natural environments.



Hi-tech control

The need to maintain heating in vivarium surroundings can be critical, especially for species originating from tropical parts of the world. Yet monitoring this reliably may be difficult, particularly if you are away or out at work.

Using the latest technology though, it is now possible to ensure that your pets are being maintained at the right temperature. FilesThruTheAir™ Wi-Fi data loggers represent a low cost, environmental monitoring system which enables you to observe, manage and record data about pets' environments wirelessly, wherever you are in the world, provided that you can get online.

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Recommended sensors for exotic pets

The WiFi-TH is recommended as a good 'all-round' choice for monitoring the environment of exotic animals, including snake and arachnids. This sensor measures humidity and temperature (between -20°C and +60°C) and is just £99 + VAT.

Another option to consider is the



One of the two model available. This is the WiFi-TH.

more versatile WiFi-TP which includes a probe, at £97 + VAT and measures temperatures over a wider range between -40°C and +125°C. The benefit of selecting a unit with a probe is that during breeding, it can be inserted directly amongst the incubating eggs.

Given that a single clutch can potentially be worth thousands of pounds, it gives added reassurance to know that you will be sent an email if the temperature suddenly spikes or falls, allowing the opportunity to react before the clutch is lost.

Further information

For more information, see www.filesthrutheair.com and do send your comments about how you're using the temperature sensors to larasian@wildfirepr.com

New lizards found in Chile



Liolaemus scorialis – one of the two new species. Photo courtesy Jaime Troncoso-Palacios; CC-BY 4.0.

A team of Chilean scientists have discovered two new species of iguanid lizards from the Laja Lagoon, Chile. These species are believed to have been long confused with other representatives of the elongatus-kriegi lizard complex, until recent morphological analysis identified them as being separate.

The new lizards belong to the genus *Liolaemus*, which contains a total 245 species to date, all of which are endemic to South America. *L. scorialis* has its name inspired by its specific type locality, composed mainly of scoria volcanic rock after which the species was named. This species is endemic to Chile where it occurs only in two localities.

The second new species *L. zabalai*, was named after Patricio Zabala, collection manager of the Colección de Flora y Fauna Patricio Sánchez Reyes, Pontificia Universidad Católica de Chile (SSUC) due to his support of herpetological research in Chile, and it occurs in both southern Chile and Argentina.

"Although our work adds two new species to the species-rich elongatus-kriegi complex of lizards from the vicinity of the Laja Lagoon, there is certainly still much to discover about the diversity of this group of Patagonian lizards," says the lead author of the study, Dr. Jaime Troncoso-Palacios, from the Universidad de Chile.



The Andean region of southern Chile where *Liolaemus zabalai* occurs. Photo courtesy Jaime Troncoso-Palacios; CC-BY 4.0.

Further information

Jaime Troncoso-Palacios, Hugo A. Díaz, Damien Esquerré, Felix A. Urra. Two new species of the *Liolaemus elongatus-kriegi* complex (Iguania, Liolaemidae) from Andean highlands of southern Chile. *ZooKeys*, 2015; 500: 83 DOI: 10.3897/zookeys.500.8725

Date for your diary

FBH Conference – 20th June 2015

Doncaster Racecourse, Leger way, Doncaster, DN2 6BB **Sponsored by Exo-Terra**

Programme

- 10:30 Registration & refreshments, tea, coffee and Danish pastries
- 11:00 **Chris Newman** – chairmen Federation of British Herpetologists Welcome & update on shows
- 11:30 **Trevor Smith** – *Indigo snakes*
- 12:15 – Refreshments, tea, coffee, biscuits
- 12:45 **Ed Pirog** – *Chelonia*
- 1:30 – Lunch, two course buffer lunch – courtesy of Exo Terra
- 2:30 **Paul Rowley** – Liverpool School of Tropical medicine – *Snake venoms*
- 3:15 **Grant Miller** – HMRC Border Force (Customs) *Illegal wildlife trade*
- 4:00 – Refreshments, tea, coffee, biscuits
- 4:30 **Ros Clubb** – RSPCA RSPCA's work on reptile and amphibian welfare
- 5:15 **The Big Debate** – chaired by Chris Newman – *The Way Forward*.

- 6:30/7:00 – Evening meal
Enjoy a fantastic dinner courtesy of Exo Terra, with licensed bar available until 11pm.

Bottled water available all day and the bar will be open before the evening meal is served.

We have hotel facilities on site for people wishing to stay over, and those who attend the conference and have tables at the I.H.S. show the next day will have first refusal on the 30 rooms available at the racecourse. We have also secured the same deal as last year at the Park Inn hotel which is just 0.8km (0.5mi) from the venue.

Tickets at £25 each (including free entry to the I.H.S. show the next day) and hotel information is now available by emailing Richard@dragonzone.org.uk or ringing Richard on 01274 548342.

This event is not to be missed, with an excellent line-up of speakers and important topics that will be discussed.

Chemical in plastic affects turtle breeding

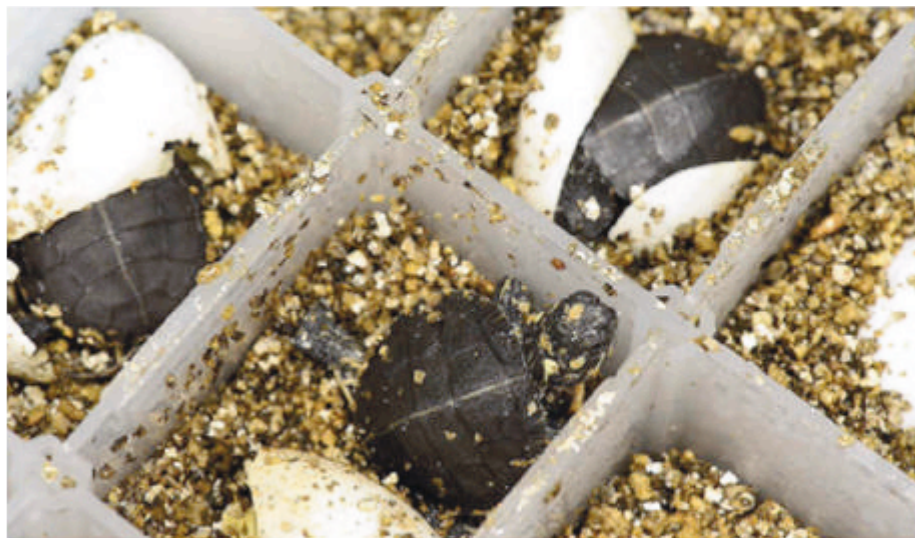
Bisphenol A (BPA) is a chemical that is used in a variety of consumer products, such as food storage products and resins that line plastic food and drink containers. Often, aquatic environments such as rivers and streams become reservoirs for BPA, with this chemical accumulating in fish and turtle habitats.

Now, a collaboration of researchers from the University of Missouri (UM), Westminster College, the U.S. Geological Survey and the Saint Louis Zoo have determined that BPA - which mimics the hormone oestrogen - can alter a turtle's reproductive system and disrupts sexual differentiation. Scientists are concerned that these findings could indicate it is having harmful effects on environmental and human health.

"Normally, the painted turtle's sex is determined by the temperature of the environment during their development in the egg. Cooler temperatures yield more male turtles, while warmer temperatures mean females are more likely to develop," explains Dawn Halliday, adjunct assistant professor of pathology and anatomical sciences in the MU School of Medicine and assistant professor of biology at Westminster College in Fulton, Missouri. "However, when turtle eggs are exposed to environmental oestrogens, their sex is no longer determined by the temperature, but rather by the chemical to which they're exposed."

Researchers applied a liquid form of BPA on hundreds of painted turtle eggs that were then kept in cooler temperatures, comparable to those needed to produce male turtles. Then the scientists examined the turtles' sex organs to determine the effects of BPA on their development. They found that the male turtles had developed sex organs with features typically found in females.

"We already know the genetic marker where the temperature-dependent sex determination (TSD)



occurs, which provides us with a good indication of where the disruption to the endocrine system is taking place," says Sharon Deem, director of the Saint Louis Zoo Institute of Conservation Medicine and a lead investigator on the study. "Our findings show that BPA essentially overrides the temperature in determining the sex of the turtle, creating turtles that are probably unable to reproduce."

For the study, scientists mimicked the levels of BPA found in samples from waterways. Turtles are known as an "indicator species" because they can be used as a gauge for the health of the entire ecosystem. According to Holliday, by understanding the possible effects that chemicals have on turtles, researchers might be able to understand the likely impacts that the chemicals have on other species, even humans.

"The doses that we tested are environmentally

relevant," adds Cheryl Rosenfeld, associate professor of biomedical sciences in the MU College of Veterinary Medicine. "If BPA has negative impacts on turtles, then it most likely has implications for human health as well."

Further information

Caitlin M. Jandegian, Sharon L. Deem, Ramji K. Bhandari, Casey M. Holliday, Diane Nicks, Cheryl S. Rosenfeld, Kyle W. Selcer, Donald E. Tillitt, Frederick S. vom Saal, Vanessa Vélez-Rivera, Ying Yang, Dawn K. Holliday. **Developmental exposure to bisphenol A (BPA) alters sexual differentiation in painted turtles (*Chrysemys picta*). *General and Comparative Endocrinology*, 2015; DOI: 10.1016/j.ygcen.2015.04.003**

Breakthrough in understanding sea turtle behaviour

It turns out sea turtles, even at just 6-18 months of age, are very active swimmers. They do not just passively drift in ocean currents as used to be thought. Researchers say it is an important new clue in the "lost years" mystery surrounding sea turtles.

Where exactly turtles travel in their first years of life, before returning to coastal areas as adults to forage and reproduce, has puzzled scientists for decades. But this finding is of more than just of academic significance.

"All species of sea turtles are endangered; knowing their distribution is an essential part of protecting them. With a better understanding of swimming behaviour in these yearlings, we can make better predictions about where they go and

what risks they might encounter," explains Dr. Nathan Putman, who is a sea turtle biologist with NOAA's Southeast Fisheries Science Center in Miami.

Upon hatching, young sea turtles swim offshore and disperse with the help of ocean currents. The turtles are rarely observed during the next two to ten years or so, but prior studies suggested that at least some reside among mats of seaweed such as sargassum, that provide shelter and habitat in the open sea, and simply drift with ocean currents.

Drifting ruled out by satellite

Putman worked with Dr. Kate Mansfield, director of the University of Central Florida's Marine Turtle Research Group, to challenge this long-existing hypothesis. Mansfield placed specially designed solar-powered tags on 24 green and 20 Kemp's ridley wild-caught sea turtle youngsters in the Gulf of Mexico.

The tags were tracked by satellite for a short period of time before shedding cleanly from the turtle shells after a maximum period of 2-3

months. Next to the turtles, Mansfield deployed small, carefully weighted, passively drifting surface buoys that were also tracked by satellite.

When the drifter tracks were compared to the sea turtles' movements, the researchers found that the turtles' paths differed significantly from the passive drifters. Using observed and modelled ocean current conditions, they found a difference in distance between the turtles and drifters to be as much as 200km (125 ml) within the first few days after the start of the study. In nearly every instance, the active swimming behaviour displayed by the young turtles appears to help them reach or remain in favourable ocean habitats.

Further information

Nathan F. Putman, Katherine L. Mansfield. **Direct Evidence of Swimming Demonstrates Active Dispersal in the Sea Turtle "Lost Years". *Current Biology*, April 2015 DOI: 10.1016/j.cub.2015.03.014**



Green turtle hatching.

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Monk 3



Grow your own food for tortoises

From now onwards through until the autumn, many tortoises will be out roaming in gardens. So what plants can you grow for your pet to browse on, in order to add variety to its diet? James Brereton has some suggestions, along with advice on cultivating these plants successfully. Here, in the first of a two part series, he concentrates on ornamental plants.

Tortoises have been popular as pets in the UK for decades, and tortoise keeping has advanced rapidly over the last twenty years. Now, several relatively hardy species of tortoises are being bred regularly and reliably, including Horsfield's (*Agriemys horsfieldi*), Hermann's (*Testudo hermanni*) and the Mediterranean spur-thighed (*Testudo graeca*), along with a growing number of marginated tortoises (*Testudo marginata*), which is Europe's largest species.

These tortoises will all eat and thrive on similar foods, requiring a herbivorous diet. Relying on plant matter, they may also be cheaper to feed when compared with

insectivorous reptiles such as the bearded dragon (*Pogona vitticeps*). There is another benefit that may be significant for some owners too, as tortoise faeces tend to be a lot less smelly as well!

Many plants suitable for tortoises to eat can be grown easily in gardens, and while this helps to reduce feeding costs, it also serves to keep them well-fed and healthy, introducing valuable variety to their diet. It is not difficult to achieve this aim either.

► Tortoises will eat whatever edible plants they come across, wandering surprisingly long distances over the course of a day, although certainly in a garden setting, they develop a feeding routine, following the sun around here.



One of the author's tortoises feeding on a piece of sedum.
Photo courtesy of the author.



▲ Sedum will also attract butterflies such as this red admiral to feed on the nectar from its flowers.

stonecrop and by its botanical description of *Sedum (Hylotelephium) spectabile*, can be purchased without difficulty in the vast majority of garden centres. This sedum is highly palatable for many tortoise species, especially Horsfield's tortoise, and the quick growth of the plant through the warmer months of the year means that leaves should be readily available throughout this period.

Being classified as a herbaceous perennial means that sedums growing outside tend to die back each winter, leaving only a mass of dry, brown stalks. However, the plants will normally regenerate in due course during the spring, with their growth cycle then repeating.

Sedums are easy to propagate

by several methods. Cuttings, for example, can be taken from growing plants in four easy steps.

1 Start by cutting a stem with a few leaves attached. Strip away the lowest leaf on the stem.

2 Place the cut end of the stem into a glass of water and keep it in a sunny, warm position such as on a windowsill.

3 Wait patiently, topping up the water level as necessary, so the bare stem of the plant at the bottom of the cutting does not dry out. Over the course of a few weeks, you should then find that the cut end of the stem should start to develop a few small roots.

4 Once the stem has established a sufficient root system, place the cutting into damp soil. Water regularly, keeping it moist and helping the roots to establish, but do not let it become saturated by standing the base of the pot in water for example. It may take a few years for a cutting to develop into a full sized plant, but this is a useful method of

▲ Leaves can be picked off the plant easily, without spoiling its appearance, particularly if they are taken from lower down the stem.



Knowledge of plant cultivation and propagation is very useful for tortoise care. Combined with nutritional information on different plant types, so it makes it easier to create balanced diets for these reptiles, with plants and equipment available through your local garden centre.

Cultivation tips

Plants can be propagated in a number of ways, such as from cuttings or seeds and by division, with more than one method often being applicable, depending on the plant. It is worth bearing in mind that growing from seed can take longer, but you will probably end up with more young plants as a result. Having a garden with a greenhouse can be very helpful, but a surprising amount of propagation can be carried out on a sunny windowsill. This is worth remembering during the winter months, if your tortoise(s) are not hibernating at this stage for any reason, as you may be able to grow fresh food for them in these surroundings, when it would be too cold outdoors.

You'll need plant pots, soil, and access

to sunlight. For some of the more difficult cuttings, you may need a good quality rooting powder: these are available online and in garden centres. Propagation is a rewarding experience and an investment: a well-planted garden may result in little need to purchase tortoise food, without any significant loss of plants and flowers, thanks to the feeding habits of these reptiles. Most general packets of seed will provide you with more plants than you actually need for your garden anyway.

Sedum

There is a wide range of sedum species available. They have attracted a resurgence of interest amongst gardeners over recent years, because not only are they very easy to grow, but in some cases, their flowers are attractive, with the resulting nectar also serving as a magnet for butterflies.

One of the most common varieties of sedum, which is offered under many names including the ice plant, showy

producing more sedum plants. Grown in pots, they can be kept in an area of the garden where they are not on prominent display, and you can collect the leaves as required.

Another way that the numbers of sedum plants can be increased is by division. To do this, dig up your sedum plant, aiming to keep as much of the root system intact as possible. With a spade, chop the plant vertically into two parts, making sure that both halves contain both roots and stems.

Both sections can then be planted separately and will grow independently into new plants. The best time to do this is in the spring, just as the plant is starting to grow again after winter. This in turn should result in plenty of new shoots and leaves over the summer for the tortoises.

At present, there is little if any nutritional information on sedums, and this may be an interesting project for anyone with access to a suitable laboratory for this type of research. However, it is clear that sedums are a popular food of tortoises, and these succulents provide a considerable amount of fluid for these reptiles. They are particularly beneficial for tortoises that have recently emerged from hibernation therefore, and getting an early supply of leaves by growing some plants in a greenhouse or on the windowsill can be very valuable.

Aloe vera

A clump of sedum growing in a flower border. Large clumps can be divided easily.
Photo courtesy of the author.



Left: Aloe vera is grown commercially in warmer parts of the world – as here in the Canary Islands – for medicinal purposes, but it is not hardy in temperate areas, including the UK.

This particular plant originates from hot, dry regions of Africa, and has been used by humans for thousands of years due to its purported healing qualities. Interestingly, aloe vera is now also sold as a health food for humans. Fortunately, this means that an analysis of its nutrients has already been completed. You can find this information, for example, at *Desert Harvest™* which is a health and beauty website whose URL is listed at the end of this article.

The results confirm that this succulent has a relatively high calcium content, which makes it valuable for tortoises. Studies of the distribution of the various Mediterranean species of tortoise have confirmed that they naturally occur in limestone areas, where the soil itself is relatively high in calcium.

Aloe vera is often slow growing, but on a sunny windowsill, through the summer, it grows quite fast. Plant it in a bowl-type container, which will allow this succulent to spread more easily. Use a well-draining compost, and keep this moist during the summer, to encourage rapid growth, but much drier over the winter.

This succulent is not hardy enough to overwinter successfully in an unheated greenhouse, so any containers here will need to be brought inside for the

summer. While it may not be possible to grow sufficient aloe vera in a temperate region to act as a major item in your tortoises' diet, it is nevertheless popular and seems to be much appreciated as a treat item by many individuals, adding to their calcium intake.

Similar to sedum, aloe vera can be reproduced either by leaf cuttings, or by separation of the offshoots, which are described in gardening circles as 'aloe pups'. When comparing these two options, separation is likely to be more successful.

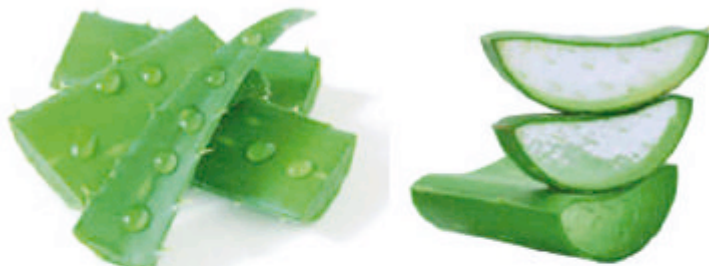
Do not be impatient, but wait until an 'aloe pup' is large enough to separate easily. It should possess at least three leaves at this stage.



It may be necessary to take the entire plant out of the pot before splitting off the pup, to obtain as much root as possible.



Aloe vera can be cut up easily into pieces and mixed with other food if required. It is recommended to strip off the spikes running down each side of the leaf with a sharp knife beforehand, as shown here.



▲ Tortoises tend to prefer eating the petals of roses rather than the leaves.

those that will flower well over a long period, rather than just producing a mass of blooms over a couple of weeks in the summer.

Foliage

The flowers are not the only part of the rose that tortoises will eat. However, mature rose leaves are tough and hard for a tortoise to rip up. This may at least partly explain why rose leaves – as distinct from flowers – are less palatable, just as in the case of other plants consumed by tortoises, such as dandelions (*Taraxacum officinale*) for example.

Few nutritional analyses have been undertaken for rose leaves. However, a zoo nutrition organisation from the Netherlands, known as *Dierenwelzijnswe*TM (or Animal Welfare Web), has conducted

▼ Select a variety carefully – both in terms of its growth and flowering habit – as well as for the flower itself. Remember that wild roses (as seen here) generally have fewer petals per flower than cultivated types, making them less suitable in a tortoise garden.

Remove the pup from the larger plant, by teasing it off initially and then cutting it free with a sharp knife, trying to keep as many roots connected as possible.

Plant the small aloe plant in a new pot of free-draining cactus and succulent compost. Keep the soil very dry for the first week, as it helps the plant to develop its root system, as will watering the pot by letting water soak up from the base. Fill the pot saucer with water for this purpose.

Roses

Both rose leaves and petals can be used as foods for tortoises. The main thing to avoid is spraying the plants with any insecticide though, as this will then prevent them being suitable for this purpose.

While you could grow roses specifically as a source of tortoise food, there is really no need. If your tortoise ranges freely in your garden, you may well spot that it is drawn to feed on rose petals as they fall off the flowers.

Simply provide the petals to your tortoise as you deadhead the flower, just as the fresh petals are dropping. Obviously, avoid using any shrivelled or mouldy flowers for this purpose, which may be a problem with heavier blooms following particularly long spells of wet weather. Depending on the rose that you have in your garden, and their flowering patterns, so you should have a good supply of petals to supplement your tortoise's food intake right through from early spring well into the autumn.

The rose family is a large one. It has been suggested that there are over 100 different rose species, quite apart from all the cultivars (or specific breeds of rose) that are available today. It is well-worth doing some research on the types that are available, concentrating on repeat-flowering varieties. You can then chose

If allowed to get large, the central growths of an aloe vera plant may develop flowers, although these are not particularly attractive.



brief analyses on the wild dog rose (*Rosa canina*) which can often be found growing in hedges.

Their results suggest the leaves are made up of roughly 26% dry matter, 18% crude protein, 32% non-detergent fibre (NDF) and 18% acid-detergent fibre (ADF). This protein content is similar to the level of crude protein present in watercress, which is 20.7% (d'Agaro, 2006).

Roses can now be purchased in pots at any time of the year, although they are traditionally planted as bare root plants in the autumn and winter months. If you buy a rose today, do not use its foliage as food for your tortoise, because of the risk that it will have been sprayed with chemicals.

Greenfly can infest new shoots, although if you have small lizards or amphibians, the aphids can be collected by sweeping them into a small pot with an artist's paintbrush, and tipped into their vivarium, making the rose bush a treble-food source! Fungal infections such as black spot, which causes blemishes of this type on the leaves, are also an issue and in this case, the only option will be not to use the contaminated leaves for your tortoises. Certain roses are apparently more vulnerable to this problem than others, and its impact from year to year varies, depending on the growing conditions.

In the case of newly-acquired plants, be prepared to wait for a year until after your rose bushes have dropped the leaves that they came with, before using parts of the plant as tortoise food, because of the risk of chemical

➤ You do not need a large area for roses – you can collect the petals as they drop off the flowers.

▼ You will have to garden organically and forego chemical sprays if you want to use roses as tortoise food.



residues. Be careful as well, when collecting the leaves, to check that there are no thorns here. Otherwise, there is a risk that thorns could penetrate the tortoise's fleshy tongue, which will bleed profusely if injured. Alternatively, they might become impaled in the roof of the mouth, where a thorn could trigger a serious infection that might be missed in its early stages. It will be better to cut the leaves right off the stems, providing them individually.

Young, softer leaves – of the type that develop on fast-growing sucker shoots – are usually preferred by tortoises. These shoots need to be cut off anyway, so the leaves in this case are ideal for feeding purposes, particularly as otherwise, they will simply be thrown away.

Clearly, you don't want to cut back your roses too much for tortoises, and it is worth keeping in mind the lower palatability of the leaves. If they are offered in combination with other foods, they may well be ignored, but they do add more fibre to the diet. Flowers definitely seem to be preferred over leaves: this is also the situation in the wild, where tortoises are known to browse

selectively on the flowers of several plant species, rather than the leaves.

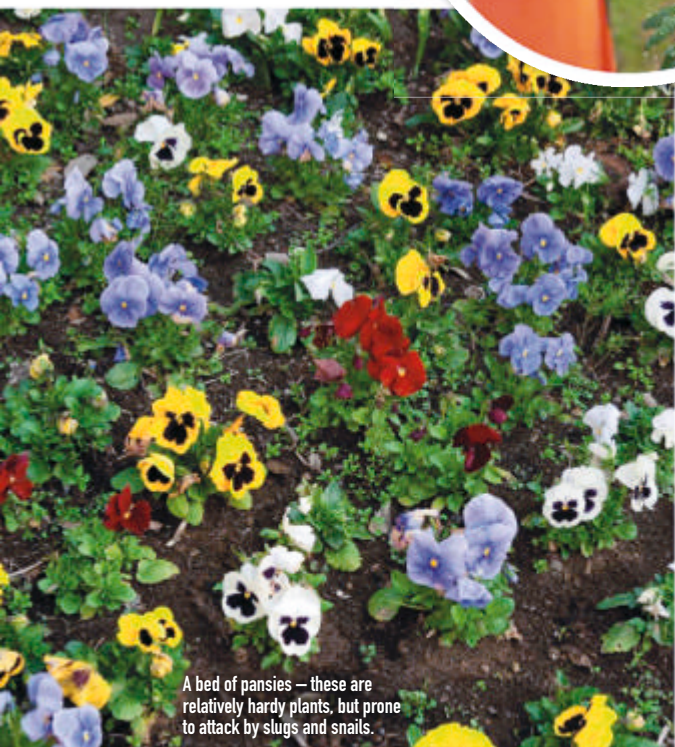
You will need to prune your roses outside the main growing season to encourage active growth and plenty of flowers, by cutting the plant back. It will then develop new shoots in spring.

It is probably worthwhile trying to exclude free-roaming tortoises from actually getting into rose beds, because of the thorns around the base of the plants. In spite of their relatively tough skin, tortoises can pick up rose thorns as they move around between the plants, and again, a thorn in the skin may cause an infection.

Pansies and violas

These brightly coloured flowering plants are available in many garden centres, and are sought after in a garden setting by many tortoises. Unfortunately, nutritional information does not appear to be available for pansies however, so that their feeding value is unclear, but they certainly will add variety to a tortoise's diet.

These plants last only one season, and are therefore known as annuals. Pansies are widely available as plug plants from garden centres and similar outlets, and they produce attractive flowers, which



A bed of pansies – these are relatively hardy plants, but prone to attack by slugs and snails.





◀ Pansies should be started off in trays indoors, before being hardened off and planted out.



Pansy seeds are quite small.

vary quite widely in size and colour. The chances are that the small plants will have been treated prior to purchase with a pesticide, and so they would not be recommended at this stage as tortoise food. You need to wait at least until new shoots are well-grown, and wash these off before offering them to your pet.

Buying pansies in this form is quite expensive, however, relatively to other foods that you can buy. A much better option will be to grow them from seed, which is widely available. This will be much more cost-effective. You simply need a tray and some seed compost, as well as a packet of seeds, which can give you hundreds of plants. Choose a colour or mix that appeals to you, as some of the resulting plants can be grown in the garden as well, away from the tortoises.

Fill the tray with compost, and pat this down gently, but do not compress it hard, as this will make it more difficult for the young roots to penetrate in due course. You then need to sprinkle the seeds thinly

It is possible to plant up troughs or pots with pansy plants, allowing tortoises to browse on the plants without reaching the roots above. Just be careful that they cannot knock them over.



over the surface of the compost. Pansy seeds are not very large, and so open the packet and tip the seeds out into the palm of your left hand (assuming that you are right-handed).

Then pick up a small number between the finger and thumb of your right hand and transfer the seed to the tray, not by dropping it in place, but by rubbing your thumb and finger together, allowing the seed to fall on to the surface of the soil. This should distribute it quite evenly over the area of the seed tray. Repeat this process until all the seed has been sown, and then gently cover it with compost.

Water the seeds using a plant sprayer, so as to avoid disrupting them or the compost, cover the tray largely with glass, or place it in a plastic bag to prevent the soil from drying out, which will be deadly for the young seedlings, and transfer it to a warm spot.

Within a few days, the young pansies will be emerging. Remove the cover, keeping the seedlings moist but not waterlogged, because otherwise they will rot. In a warm, well-lit spot such as a

◀ In suitable surroundings, pansies will spread.

▼ A watercress farm. This plant grows in water, and is a valuable source of iron.

greenhouse, the plants will start to grow rapidly, and they can then be transferred to large containers and grown on into bigger plants.

When roaming around a garden, tortoises do develop their own feeding preferences, in terms of plants. If you have an area of the garden set aside for them, you can offer a succession of pansies here as food, while you can enjoy the flowers of these plants elsewhere. Simply have an area of soil where you can put the plants, replacing them as necessary. Always keep them watered here, so they will not wilt.

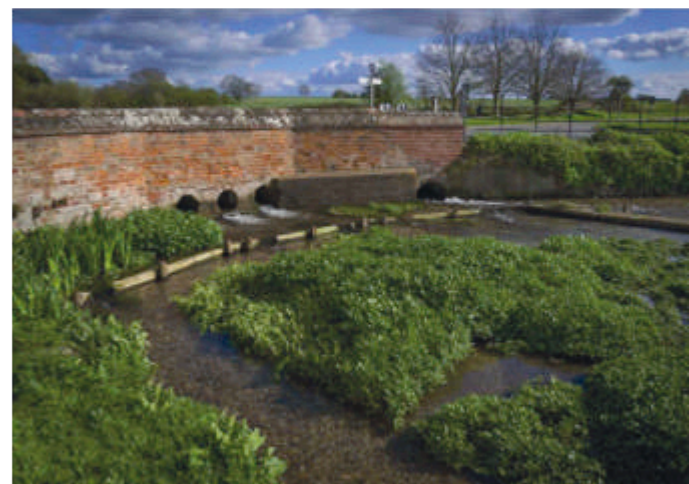
Supermarket plants

Some food plants may be purchased in food shops and supermarkets. These include watercress (*Nasturtium officinale*), not to be confused with the garden nasturtium (*Tropaeolum majus*) that can be very easily grown from direct sowings of seed. Garden nasturtium seeds are large, and easily placed individually in the ground. Ideally, these should be sown into relatively poor soil, so as to produce a better balance between flowers and leaves. In rich soils, the plants grow very actively, but tend not to flower so well. There are various forms and colours, but trailing varieties are preferred over climbing ones, as these will obviously be more accessible for tortoises.

Nasturtiums are pretty undemanding plants, and tend not to be eaten by slugs and snails compared with pansies for example. However, they are annuals and will die back in the autumn, being hit by frost. Having a succession of fresh food for tortoises can be important, especially if they are not hibernating for any reason.

Members of the cabbage family such as kale (*Brassica oleracea*) can be very useful in the late autumn through until early spring with other home grown food sources being less readily available over this period.

You can purchase supplies from



supermarkets, but when buying food of this type, keep in mind that it has probably been treated with chemicals, unless it is stated to be organic. It is always recommended to wash shop-bought food items of this type in any event. Keep in mind as well that the nutritional value of such foods may be reduced, in comparison to garden plants that are eaten within minutes of being picked, especially with regard to their vitamin content.

On the other hand, the leaves of kale will last some time in the fridge, and can be used as a back up supply of tortoise food. Furthermore, brassicas are grown for human consumption, so there is much more information regarding the nutritional value of this group of plants. In fact, it is important not to rely solely on cabbage-type plants as food for tortoises. This is because they contain what are known as goitrogenic compounds that can restrict the functioning of the thyroid glands, which are important in regulating the body's metabolism and overall level of activity.

As always, the emphasis should be on providing a mixed, varied diet, which helps to replicate the tortoise's natural browsing habits. In the wild, these reptiles

Pictured:

1: Nasturtiums can be sown directly into the ground, or started off in pots, as here.

2: Nasturtiums trailing out of a raised bed provide tortoises with good browsing opportunities, while protecting the plant.

3: Nasturtium seeds, with a flower in the background.

4: Curly kale is the type most favoured by tortoises.

5: Various types of seed tray are available for the young kale.

6: It is possible to buy kale plants later in the year for transplanting outdoors into the soil.



will eat dozens of different types of plants, which collectively serve to provide them with a balanced diet.

Should you remember to plan ahead though, kale is a very easy crop to grow from seed, and now is a good time to sow the seeds. It is usually better to start them off in a seed tray, to deter attacks by slugs and snails at this stage.

The seedlings can then be transferred to pots and then ultimately planted out in the ground. They may be at risk for a period over the summer from attacks by cabbage white butterfly caterpillars, but if you have lizards or amphibians, these can be used to supplement their diet. The leaves of the kale will regrow in due course, for when they are to be harvested in late autumn and over the winter.

Nutritional variations

Not all plants contain the same amounts of nutrients, and this includes minerals. Even plants of the same species may differ significantly in terms of nutritional value, depending on the soil type in which they are growing. Plants grown in mineral-rich soil, therefore, are more likely to be



nutritionally valuable.

It may well be possible to improve the feeding value – and specifically their mineral content – by improving the soil. As mentioned previously, tortoises in the wild are encountered in areas where chalk/limestone is prominent. These calcium-rich substances can therefore be buried beneath tortoise gardens, and over time, they should help to maximise the calcium level present within the plants, as this vital mineral is absorbed through the root system.

In conclusion

This article has focused on just some of the most popular and easily cultivated plants that are suitable as food for tortoises roaming outside during the summer and for use over the winter. In the next issue, I shall be looking at the many types of weeds that can form part of their diet, including clover, plantain, and the all-important dandelion, as well as how to cultivate and – as necessary – contain these plants so they do not take over your garden. ❖

▲ The browsing habits of tortoises mean that they are unlikely to decimate plants. They tend to nibble some leaves or flowers and then move on, provided they have a choice.

▼ Tortoises favour limestone areas, where calcium levels in the plants are relatively high. Soil does make a difference to the nutrients in the plant.

Further reading

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Diary of a mantella man



Adventures in Madagascar

Part Two

Joshua Ralph continues sharing his report from Madagascar, detailing what else this amazing island has to show the world, ranging here from unknown species of *Guibemantis* frogs to the enchanting and odd-looking giraffe neck weevil.

I remember walking through the town and noticing every little detail around me, from the smell to the sights that surrounded me but the one obvious thing was that I was the new guy in town. Let's just say that I learnt the common Malagasy greeting incredibly quickly. I had to say it to everyone, out of politeness but also because I wanted to be friendly!

Rainforest destruction

On our way out to the edge of town, on the main road that takes you towards the National Parks, I noticed an extremely well preserved (yet seemingly almost new) building with big capital letters on the sides of it stating "ANDASIBE". I asked my companion Devin exactly what the place was and why it appeared abandoned when it looked so new. Yet it turns out that I actually knew this building, as a hotel from reading about Sir David Attenborough's adventures there in the 1960s.

➤ One of the many tree nurseries which Association Mitsinjo uses to grow saplings on, ready to plant back in the forest.



All photos by the author apart from p17 top.



The diademed sifaka used to roam much closer to the town. Source PD.

This was the Andasibe Train Station Hotel, and it had accommodated quite a few celebrities including Gerald Durrell, Prince Philip and of course Sir David himself. Devin reminded me that part of the area here was described by Sir David as rainforest right outside his window with diademed sifakas (*Propithecus diadema*) – a type of lemur – amongst the trees. Now a restaurant where I often eat has been constructed on the site. It is a disturbing thought looking around now, and considering just how far the rainforest has been pushed back over the past 50 years or so.

Mitsinjo Breeding Facility, Andasibe: my first impressions

After a 45 minute walk and a struggling uphill climb to the facility, which just proved how unfit I had become, we arrived at the Mitsinjo Breeding Facility, something I had been eagerly waiting to see for well over a year. The first thing you notice about the building, once you open the gate, is the vast number of logos from various organisations across the world supporting the project. It was a truly impressive and fantastic sight to see, although as I was to discover inside, the

presence of one of these logos should never have been allowed there, although that's biopolitics for you!

Bio-security in action

We entered and already, I was impressed with the protocols and procedures we had to go through before even entering the facility! Provided for the staff members, volunteers, PhD students and researchers is footwear in the form of either foam crocs or Wellington boots that are just for use within the facility's main building.

Your clothes must be clean before you are allowed to enter, with no traces of mud evident just in case you could be carrying a lethal pathogen. Biosecurity is taken very seriously in these parts, particularly with the presence of chytrid fungus now confirmed on the island, which has already wiped out so many amphibians on a global scale.

Luckily, I fully disinfected my clothes prior to leaving the UK, using Virkon® and Anigene. I was extremely excited and full of anticipation to just get in and view the facility and the legendary and highly important wild caught founders of the



golden mantella (*Mantella aurantiaca*) Ambatovy strain being bred there.

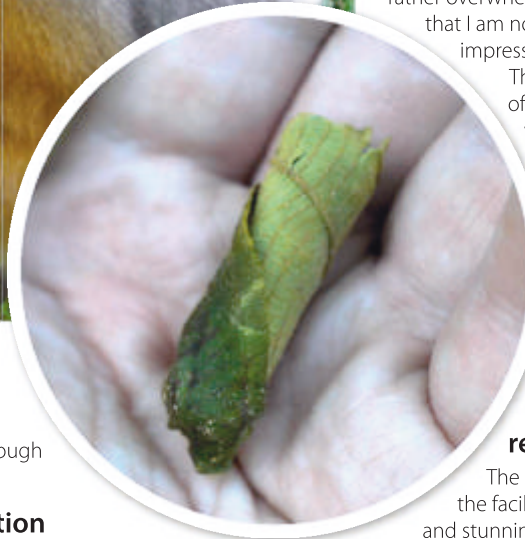
As I finally entered, I was straightaway presented with a vast quantity of fruit fly (or 'Sis' in Malagasy), springtail, tropical woodlice and cricket cultures. These were rather overwhelming considering those that I am normally used to. It was impressive, to say the very least!

Then we approached a set of heavy wooden doors, which gave access to the frog research and collection room. This is home to over 800 specimens, of eight different species that fall within the Conservation and Husbandry Research programmes.

Mining destroys irreplaceable habitat

The obvious and main focus of the facility though is the famous and stunningly beautiful golden mantella (*Mantella aurantiaca*) specimens, a species classified as critically endangered based on the IUCN Red List. However, what makes these particular specimens so important is not as well known to the outside world, and is linked directly to one of the logos upon the wall of the facility's supporters.

The wild caught founders of this particular group were once found in the Ambatovy locality within the northwestern part of the Torotorofotsy Wetland reserve. However, a few years



▲ The dried up egg case of the giraffe neck weevil.

▼ Sophie's tree frog (*Guibemantis sophie*) is a species yet to be described, but I hope to return soon to begin researching it properly and officially name it.



Like something out of a wildlife documentary, a queen ant trying to feast upon *Guibemantis pulcher* tadpoles still in their spawn.





previously, it was discovered that this particular area had a vast amount of valuable nickel within it. As a result, the Ambatovy Nickel Mining Company got permission to destroy the habitat, provided they contributed and removed all the surviving golden mantella specimens from the remaining four ponds and gave them to Association Mitsinjo.

As a result, the mantellas that I was looking at represent the only survivors of that population today. People talk rightly about concerns over the sourcing of timber products, but perhaps it is time to place more emphasis in terms of mineral extraction as well, when it comes to ensuring the ethical sourcing of items that we use in our daily lives?

Amazing dedication

During this initial visit to the Mitsinjo Breeding Facility, I met some members of the team including the team supervisor, Justin Claude Rakotoarisoa, who is well known for guiding Sir David Attenborough around the Mitsinjo Forest. He also accompanied the British actor Martin Clunes, when he presented the ITV documentary *Martin Clunes: The Lemurs of Madagascar*.

We discussed many things, including some of my experiences working with these and other mantellas and what I would be doing whilst spending my time there; we also discussed in great detail how the centre functions on a daily basis.

Several technicians work daily, each of them on their allocated sections, including husbandry research plus live foods and culture maintenance.

What was most remarkable to me, however, was that when



▲ Male specimens tend to be rather common in their preferred habitat. Being sexually dimorphic, males have longer necks, which allows them to fight in their characteristic style.

◀ Completely unique and endemic to Madagascar, the lowland streaked tenrec (*Hemicentetes semispinosus*) is a beautiful species to observe.

working with amphibians in the collection, the team give a visual health check to every single specimen on the premises. That adds up to well over 800 animals in total.

The dedication on display is amazing. I was really surprised and also incredibly impressed, as this is not a practice I had encountered before. These health checks are on top of humidifying the exhibits, feeding the specimens on set days and cleaning at least one exhibit from each of the sections.

Mitsinjo Forest and the Parc des Orchidees, Andasibe: a stroll in the woods

Plans for my trip to Madagascar had started over a year prior to the actual date of my arrival. Discussion had centred on what I would be doing at the facility, things I had to do or places to visit and finally, sharing my experiences and advising the rest of the team. One of my recommendations was related to the culturing of certain live food items, specifically as to how I keep isopods and detritivores (clean-up scavengers) such as springtails and tropical woodlice.

I spent the morning planning and working out in my mind what I would need to collect from the rainforest, going over it repeatedly, trying to determine what I would have to substitute for certain items that I simply wouldn't be



◀ Andasibe Train Station Hotel has accommodated many celebrities including Sir David Attenborough.



The Mitsinjo Facility is Madagascar's first bio-secure facility, to ensure that the insurance population of the golden mantella survives.

able to get here in Madagascar. It added up to quite a lot of things, except for the fruit and fungi that I could get hold of easily!

Eventually, I had my plan set and I made my way with haste to the rendezvous point so I could meet with Linah and Dina, who would act as guides so I could enter this protected area safely and securely. By this stage, I still hadn't become used to the walk to get to the National Park area, with the breeding facility itself being even further away.

Getting to work

To make this trek more challenging, an unusual blister-like lump had appeared upon my heel. This did not look sore, but was exceedingly painful and causing me to limp uncontrollably. It didn't really concern me though; after all, a blister is a blister... right?

I eventually arrived at my destination, slightly earlier than I anticipated, although I didn't mind this at all; it gave me the opportunity to be alone near the edge of the forest reserve so I could just soak up the atmosphere that oozed from this

wondrous place. Eventually, my guides and pupils for the day arrived at the entrance of the Parc des Orchidees (Orchid Park) and I discussed the plan I had in my mind, as best as I could with the little Malagasy I knew, and with the little English they knew!

We strolled on in, and I knew for Dina and Linah, this was an everyday occurrence to them, but for me, this was like walking on the moon for the first time! Immediately, wildlife was around us in terms of many species of flora and fauna that could be found in the area.

The first thing that caught my eye was a male Malagasy jumping frog (*Aglyptodactylus madagascariensis*), hiding amongst the leaf litter on the edge of the pathway. Even though I have to admit that this species is a common find, I was still delighted to see it.

Eventually, we reached the lake area in the centre of the park and from there, we decided as a group where to look to find the first item on our list, which were rotting logs or wood. Unsurprisingly, that didn't take very long to find in the forest.

New discoveries

A mere minute or so later, we discovered some suitable timber that was rotting away. As we were taking it apart, so we spotted a beautiful looking species of millipede, belonging to the class Diplopoda.

Unfortunately, like many of the species of arthropod on Madagascar, it was completely unknown to the scientific world and was therefore nameless. We watched it for a short time, which gave me the opportunity to take a few photographs, and then we moved on.

Having found everything we needed, it was time to leave the forest, so Linah suggested walking back the long way round, rather than using the way we came. I was only too happy doing that! We started to walk up the hill in the direction of the Mitsinjo Breeding Facility, and I soon found myself looking amongst the vakona plants, which are better known to us as pandinus palms.



▲ Each and every specimen is health checked, all 800 plus specimens, on a daily basis. Justin is shown here, carrying out this task.

In the first plant that I looked in, I disturbed a tiny frog that jumped out from its centre and on to the outer leaves of the plant, in a perfect position for me to photograph it clearly. It was truly beautiful and neither of my guides could identify the species.

Later on, it was confirmed to me that this in fact was a new and undescribed species belonging to the *Guibemantis* genus. It was truly outstanding as a specimen, and I decided there and then that I would name it unofficially until either I came back to describe it properly or if someone else did it before me. I decided to name it after my incredibly supportive girlfriend. As a result, Sophie's

tree frog (*Guibemantis sophiei*) came into being!

Ant attack

Our trek continued and eventually we reached what had become a familiar place to me – the Mitsinjo Tree Nursery, just outside of the boundaries of the rainforest. This was where all the saplings and shrubs were grown to a suitable size or life stage that would be ideal to reintroduce to a reforested area or land that is being planned for reforestation in the future.

By this point, we didn't have long until we would have left the forest – no more than another minute or so. I admit that I was feeling slightly unfulfilled, as if I should have seen more in the forest that day. But instantly, my excitement returned upon the sound of Dina's voice calling out that she found something.

Turning round and nearly falling over in the process, I leapt to see what she had discovered, and found something that you really couldn't plan or even hope to see – at least in the wild. I realised that I had seen this phenomenon before, captured on film for the BBC series on Madagascar, with Sir David Attenborough, which was first broadcast back in 2008.

Before my very eyes, a flying queen ant was attacking tadpoles within a mass of Tsarafidy Madagascar frog (*Guibemantis pulcher*) spawn that was dangling above a



◀ The staff at the Mitsinjo Facility work incredibly hard, making sure every tank is clean, just like Mampionona is pictured doing here.



slow moving stream. It was simply unbelievable, watching this queen ant trying to remove these delicate tadpoles that were not yet ready to hatch. This provided a very exciting end to the day and it left me keen to experience more.

Getting jittery with jiggers

For at least a week, I was suffering with awful blisters on my feet, but although they were painful, I consoled myself with the fact that were not serious... Or so I thought, at least. After a while though, one particular blister began to change, in a pretty obvious way, in both size and colour.

To apply one of my fingers gently to the surface was the equivalent of touching my skin with a hot iron rod! I began to suspect this was something more sinister here than the average blister.

Across the planet, there are some nasty parasites or illnesses that can be contracted, even by relatively careful travellers., Madagascar certainly is no different in this respect and has some interesting illnesses. It is home to the sand flea or jigger, which has the distinction of being the world's smallest species of flea.

The sand flea happens to rather enjoy burrowing beneath your skin in the soles of your feet, or in fact, any skin on your body that is accessible to it. After a while, it finally clicked that I had one of these passengers.

A painful conclusion

In the end, I decided that enough was enough. I had to cut it open and relieve some of the pressure building up here, and remove the flea before it could trigger an infection. I prepared myself for cutting it open by sterilising my Gerber knife, a clothespin and my metal pair of



▲ *Mantidactylus grandideris* not only incredibly loud at night, but also incredibly bold and large.

tweezers with some medical grade ethanol.

Before starting, I took a few swigs of my Three Horses Beer and got straight to it. At first, the pain was bearable, and it was only once I grabbed the flea that things became much worse.

I gritted my teeth and grabbed every instrument I could in my determination to remove the parasite. Each time I touched it, I could feel tears running down my cheeks until I finally pulled it clear between the points of my tweezers. Immediately, I held the flea in the tweezers above a candle flame to kill it off. It taught me a valuable lesson - never take your socks off in Madagascar!



Orchids are amazingly diverse, with some only having flowers the size of your fingernail or even smaller.

▼ *Heterixalus punctatus* is both incredibly beautiful and also abundant in the area, even after spawning season.

Mitsinjo Forest Tree Nursery, Andasibe: my quest to find the giraffe neck weevil

The very next day, after my stroll through the Parc des Orchidees and the Mitsinjo Forest Reserve, I remembered there was something that I really wanted to see on my trip but hadn't come across as yet. I thought there was quite a good likelihood that I would though, because it is known to be incredibly common within its distribution range.

The species in question - the giraffe neck weevil (*Trachelophorus giraffa*) is a small and curious arthropod that, like most species of fauna and flora found on Madagascar, is found nowhere else on the planet, being endemic to the island and unlike anything I have seen before. I simply had to find it for myself.

Like any other morning, I woke up after a ridiculously short amount of sleep, from an illness that started to manifest itself in the form of severe abdominal pains, causing me to sweat so profusely that this gave me the appearance of having had a bucket of water thrown over me. However, I'd come a long way to get here

and I wasn't about to let whatever this was to stop me from seeing this amazingly beautiful country!

So, I made my way to the facility, a normal 45 minute walk for me, accompanied by the usual melody of wailing Indri lemurs (*Indri indri*) and the kind greetings of the local people walking to the parks to start work. One boy on a bike however, slowed down beside me and started speaking French.

I explained that I was British and he immediately changed his dialect to match my own and proceeded to ask me a series of questions; the main one though was "Do you speak much French?" Once our conversation was over, he rode on ahead of me.

A prickly prospect

I easily caught up though, as the lad was standing still looking towards the floor at the side of the road and this raised my curiosity! What on earth could he be looking at? Then it suddenly hit me; I am in the middle of the rainforest, so it could be something amazing, which caused me to start sprinting almost subconsciously. When I got there, I ended up bursting into laughter and unable to talk. I patted the boy on the shoulder and thanked him, even though he did nothing. Down on the side of the road, eating a earthworm was a species that I have cared for in private and professional collections.

It was something that I always wanted to see on my trip. It was a baby lowland streaked tenrec (*Hemicentetes semispinosus*), a remarkable species that that looks rather like a cross between a European hedgehog and a shrew. Unfortunately though, it ran off before I could take a photograph.

Where to look?

I carried on to the facility and started performing my usual duties of the day, until a short time afterwards, my friend Justin Claude (JC for short) came over and



Chameleon species can be very hard to find during the day, so it is a rare treat when you can see one, like this female Parson's chameleon (*Calumma parsonii cristifer*).



we began to chat. There was one particular thing that I needed to find out, and that was the likelihood of me finding the curious giraffe neck weevil. Much to my surprise though, what he told me was not something that I expected.

JC informed me that they were incredibly easy to find, especially on a sunny warm day where they would be resting upon the leaves of their two favourite trees, known as *Dichaetanthera cordifolia* and *Dichaetanthera arborea*, soaking up the warmth. That was it, I had to go and find them, which I did immediately after work, following the directions that JC had given me.



A successful encounter

Once I arrived at the Tree Nursery, it was not long before I found a definitive clue to show that they were here, in the form of a dried and curled up leaf. Now to the normal everyday tourist, this would not be something that would make you excited, but for me, it was a fantastic thing to be able to hold in my hand and study.

This was an old discarded egg case; of course the offspring was long gone as when the leaves dry out and turn brown with decay, this is apparently the time when the young weevils hatch out and start their lives. Looking up though, blocking the sun's glare from my eyes with my hands, it wasn't long until I found what I was truly here to see and I must admit, I was left speechless.

There they were – five specimens all together – and performing their characteristic courtship behaviour. Males were fighting over females, using their long necks to knock over their adversaries.

I tried to grab a branch and gently pulled it down, but as soon as I would get close, the weevils would pretend to die and fall off the leaves. Then in mid air, they would suddenly begin to fly, leaving me disorientated trying to work out whereabouts they landed next.

Being a mere 2.5cm (1in) in size, these weevils are really hard to spot and I cannot deny that even though it is just a small insect and that I am a amphibian lover at heart, it was truly a remarkable sight to see. ❖



▲ The short-horned chameleon (*Calumma brevicornis*) uses its elephant ear-like appendages in a similar manner when threatened, raising them to increase its apparent size to ward off potential threats.

◀ Darwin's bark spider (*Caerostris darwini*) measures only 2cm (0.75in) in size and is easy to find. However, this species produces the largest web of any orb weaver spider, and its silk represents the toughest and strongest biological material on the planet.

Missed out?

You can obtain the first part of this article – and indeed any other back issues that you want, subject to availability – by calling 0845 873 9270. Each one costs £5.20 including p&p.



COMPANY PROFILE: NAMIBA® TERRA

This German-based company was founded in 1996 by Lutz Weynans. A keen reptile hobbyist himself, he used his experience and observations on animals such as lacertid lizards in the wild to start to develop a range of products to meet their needs in vivarium surroundings. The company's name was inspired from the sand - 'Terra' - that Lutz imported from Namibia and sold as a vivarium substrate.

Environmental awareness

Ethical trading is a strong passion of Lutz's, and this is clearly reflected in the way that the company operates. As he points out, people who keep animals such as reptiles are more likely than average to be concerned about environmental matters too. He mentions his worry that the level of carbon dioxide in the atmosphere caused by the emission of greenhouse gases from industrial countries is affecting the tropical rainforest vegetation in South America.

The company has come up with a novel solution to addressing the liana problem in Ecuador. Parasitic plants such as lianas are now growing much faster than the trees themselves, with the danger that they will be suffocated by these climbers in the longer term. Unlike many people however, Lutz set out to do something positive about the problem. Namiba® Terra has therefore set up an inspirational scheme involving the indigenous tribes from the region. With permission from Ecuador's Department of the Environment, native tribespeople are targeting the lianas in the rainforest, preventing trees from becoming choked.



The company has come up with a novel solution to addressing the liana problem in Ecuador.



Namiba® Terra has created a range of specialist foods for day geckos and other species.

Ethical sourcing

By purchasing the cut lianas, so Namiba® Terra can offer handpicked products to its customers, in the certain knowledge that they are not waste products from illegal clearance of areas of rainforest. Furthermore, this association provides local people with an additional income, while helping to preserve their traditional way of life.

Such attention to detail is also apparent in the sourcing of other Namiba® Terra products. All their coconut-based items are derived from plantations in the central part of the island of Sri Lanka. Here they will be free from salt contamination that is invariably a feature of palms growing in coastal areas.

Namiba® Terra Coir fibre products have been supplied by the same Sri Lankan producer for over a decade, helping to guarantee their quality. A further sign of the company's attention to detail is that the packaging of its products on the island is carried out entirely in small factories that manufacture exclusively for the reptile market. This in turn avoids any risk of coconut-based products becoming contaminated with different, fertilised substrates used in the gardening sector.

Commitment to welfare

Closer to home, Namiba® Terra is very closely involved in organising training for retailers. The company also works collaboratively with the VDA/DGHT training centre of Kempen/Rheinberg to offer courses and examinations that meet Germany's animal protection laws.

Namiba® Terra's lighting units are made in Europe, and according to the company, this guarantees the highest standards of quality. Their ultraviolet (UV) lights are tested independently for their radiation characteristics, to ensure they are safe and effective, by Berlin Technical University's light engineering department.

Innovation

There are a number of distinctive products which Namiba® Terra offer, some of which such

as their ProtectoRep® Clamp Lamp have won industry awards. The company is also offering one of the largest selection of drinkers and food bowls on the market, in a wide variety of sizes, and available in ceramic or resin. There are terraced water bowls for example, with what are effectively steps inside, available in a range of shapes and colours. In areas where space is limited, then a terraced corner bowl or feeding dish could be the answer.

The Terra-Puzzle® range has also proved very popular since its introduction. These bowls are available with red, yellow and green glazes, to help them merge into the background, whatever type of vivarium you have, from desert to rainforest.

Namiba® Terra has recently introduced a very realistic set of artificial plants, suitable for all different types of habits. The range includes cacti, succulents and various vines, that will provide good cover in a vivarium.

Another successful addition to the Namiba® Terra range has been the Terra-Puzzle® Shelter Shells, made of natural earthenware which retain moisture, unlike plastic retreats, and so can assist shedding. Terra-Puzzle® Frog Hides have proved popular with amphibian breeders, and the company has also developed special foods for crested geckos, day geckos and beetles which are now available. ❖

More information

* Wholesalers in the UK keen to discover more about the Namiba® Terra range should email info@namibaterra.de or telephone Lutz Weynans on 0049 2152 89290. The full catalogue can be found at <http://www.namibaterra.de/service/kundencenter/downloads/download-catalog/?L=1>



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Reptiles at the Cotswold Wildlife Park

Nestling in the beautiful surroundings of the Cotswolds is the UK's largest privately owned zoological establishment, which is open to the public. There are more than 260 different species of animals to be seen at the Cotswold Wildlife Park and Gardens. Right from the start, over 45 years ago, reptiles have always been very well-represented here, and the park is now home to one of the biggest reptile collections in the country, as Susie Kearley reports.

Moving with the times

When I arrived at this splendid facility, set in 64 hectares (160 acres) of grounds, I was greeted by James Reynold, who is the park's reptile keeper and has worked there for the past eight years. He explained the current thinking behind the collection, and the major breeding success that has been achieved with Morelet's crocodiles over recent years.

"When I first came here as a junior keeper, the reptile house needed a refurbishment. It was quite difficult to access some of the cages, because a number of them were high up, and others were quite small," he says. "It was stuck in the 1960s and we wanted to keep a more diverse collection of reptiles

➤ Amongst the spectacular species on display in the reptile house is the veiled chameleon.





and have various sizes of enclosure to accommodate different reptiles.

"Funds were found and the reptile house was renovated and redesigned, to provide better access for keepers, more suitable enclosures for the animals, and more space. Once all the work was done, we acquired some green tree monitors, Uta iguanas, Fiji iguanas, and Yemen (veiled) chameleons.

"We selected the species for a variety of reasons – some are endangered and we wanted to be involved in their conservation. Uta iguanas and Fiji iguanas fall into this category," James explains. "Others, like our red tailed racers, move a lot, which makes them interesting for visitors. Some like the chameleons are strange in appearance and/or brightly coloured so together, they're a good mix of species for visitors to enjoy. We have both tropical and desert species in the collection as well."

Successful breeding

So what about their success with crocodiles? "We've bred Morelet's crocodiles now for some time. To be honest, they proved easy to breed, once

they were mature. We'd had a pair for nearly ten years and they hadn't nested before. Then in the first year that I came to work here, they reached the right size and condition. Their environment was perfect for breeding - we had ultraviolet (UV) lights, the correct temperatures, and a deep pool for mating," James explains.

"The next thing we knew, the female started to develop a swollen abdomen and she began to dig nesting holes, so we were pretty certain that we were going to get eggs. It was an exciting day when we saw her lay for the first time. Then we had to go into her enclosure to collect them, armed with lots of boards to protect ourselves, because she became really aggressive and protective towards her clutch.

"We incubated the eggs artificially, to give us more control. As a general rule, we only incubate eggs when we can guarantee to find homes for any young that hatch. Morelet's crocodiles can live up to 100 years, so we have to be very careful, especially as we can't keep them all ourselves!" James explains.

"Fortunately, we've managed to find homes in other zoos and wildlife parks for



▲ One of the breeding Morelet's crocodiles at the Cotswold Wildlife Park. Source PD.

quite a number of babies since the female laid her first clutch back in 2007 and she's nested repeatedly since then. We've incubated her eggs and found homes for the hatchlings every time.

"When we are hatching the eggs to supply another zoo, we keep the young for a period afterwards, before they go to their new surroundings. All the Morelet's crocodiles that you can see today in collections in the UK originate from the Cotswold Wildlife Park. We are the only breeders. If another zoo wanted to breed them, then it's always possible to get





new blood from crocodile farms in their native country of Mexico.

"We can't incubate eggs and send the young to be released in their native range in the wilds of Mexico, Belize or Guatemala because it would be possible that they've picked up some pathogens (disease-causing organisms) to which the native population might have no resistance, and this could have a devastating impact on the population. That's why we leave the reintroductions to the farms breeding these crocodiles within their native range."

How farming helps

"Morelet's crocodiles have quite supple skin and so their skin has been in demand for use in products like handbags and boots. This is one of the reasons as to why their population has suffered badly," James explains. "The reintroduction programmes of crocodile farms in Mexico has helped the wild population to become more stable now, creating a brighter future for them, by reintroducing some of the stock they breed back into their native habitat."

"There are a lot of species of crocodilian around the world which are threatened because of loss of habitat – specifically loss of egg laying sites, from people building around riversides, disturbance and water pollution. Even some of the fish they eat are so polluted that the crocodiles are poisoned by the pollution. Conservation is an ongoing battle," admits James.



▲ A Morelet's crocodile photographed in the wild in Mexico. They are becoming increasingly scarce in the central American homeland.

▼ Saltwater crocodiles are now becoming common again in northern Australia, as the result of farming.

"Climate change also represents a longer-term threat. Just small shifts in the environmental temperature can impact on the gender of the young crocodiles, as the result of TSD – temperature-dependent sex determination. Some get hunted and in certain areas, others end up mating with different types of crocodile, creating hybrids. We obviously work with the true species – that is one of the advantages of captive breeding."

But things can be turned round.

"During the 1970s, saltwater crocodiles were brought back from the verge of

extinction in good numbers, due to the work of crocodile farms breeding them," says James. "They also provide local income and employment, centred around the farm concept; it is similar in a way to what we do with cows, although a percentage are generally returned to the wild."

"The crocodile species that are very endangered are afforded greater protection, but in general, the problem can be that once an animal becomes endangered, so it becomes more appealing to collectors who want one for





▲ The radiated tortoise (*Astrochelys radiata*). It is hoped that it will be possible to breed these tortoises successfully before long.

James' tips when starting with reptiles

"Always really research a particular species before you buy it. Collect as much information as possible, so that you're fully aware of what you're taking on and what your responsibilities will be. Speak to breeders. They must be doing something right to be able to breed their animals! If you're not confident about the seller, don't buy. Healthy reptiles should have bright eyes and look in top condition."

The Invertebrate House

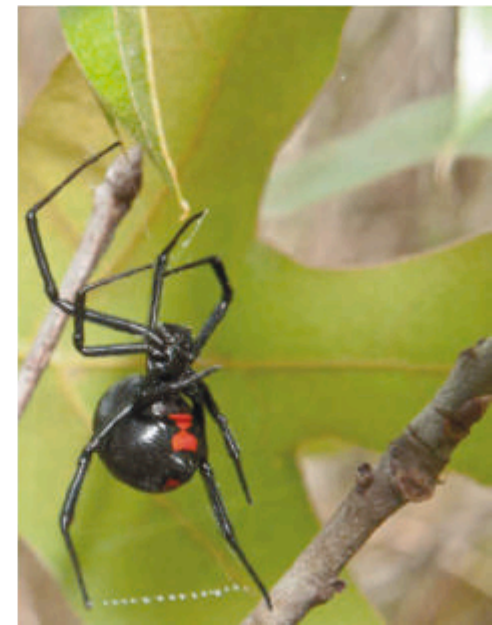
On the day that my husband, Vic, and I visited Cotswold Wildlife Park, we started by stepping out of the wintry cold into the tropical climate of the Invertebrate House. As the warmth penetrated our chilly bones we relaxed, before turning to see a huge bird-eating tarantula staring at us from inside a vivarium.

While these spiders only apparently eat birds rarely, they can easily break human skin with their fangs and leave you in severe discomfort with nausea and sweating from the bite, if carelessly handled. We were glad that this

◀ Black tree monitors are confined to the Aru Islands near Papua New Guinea, and can grow up to 1.2m (4ft) long.



➤ Black widow spider. There are three different North American species in the genus *Latrodectus*.



themselves. Certain tortoises such as the radiated have been very badly affected by this very mentality.

"Zoos often aid conservation and breeding programmes in the animals' native countries by providing funding to help preserve habitat and support native breeding programmes. At Cotswold Wildlife Park, we concentrate on a Madagascar breeding programme, which assists the lemurs, reptiles, birds and insects on the island. I'd love to do more conservation with particular reptiles but we have limited funding."

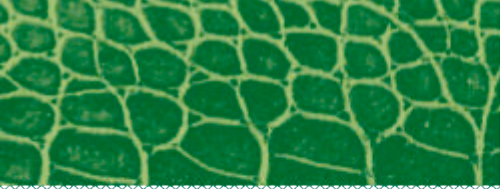
Future breeding plans at the park

I asked James about future plans and priorities for the collection. "We'd like to breed more reptiles. One species we're trying to crack is Fiji iguanas. We have

two pairs. There's a young pair that haven't been put together yet, and an adult pair who have been together for several years – the first clutch of eggs that they laid didn't hatch. It takes time for the animals to mature. This year, we'll hopefully get a good clutch.

"Black tree monitors are another species that I'm very keen to breed. The pair here laid their first clutch of eggs this year, so we hope we can build on this going forward, and start to hatch the young regularly. This species has a very restricted range in the wild.

"Radiated tortoises are a third species where we're desperately keen to get hatchlings. We've had eggs in the past and now we're looking at different incubation methods, to find out how we can get them to hatch on a regular basis."



A blue dart frog (*Dendrobates azureus*)—one of the colourful dart frogs to be seen in the collection.



individual was securely housed behind glass and hoped that his mate hadn't escaped from her enclosure either, although we didn't see her!

The tank below looked almost empty and relatively harmless, until Vic pointed out that there was a black widow spider inside from North America. Isn't that the one that's notoriously deadly? The female black widow is renowned for eating her partner after mating and for having a toxic venom that can result in coma and death in people.

We moved on to see a large vivarium containing locusts, and another holding poisonous dart frogs. There were several species inside, including blue, green, black and yellow banded frogs, as well as golden dart frogs. These colourful amphibians have a toxin in their skin, derived from their invertebrate prey such as ants, that Amazonian tribes use for tipping their arrows when hunting prey.

Elsewhere, there are stick insects, giant snails and a tank of Amazonian red-bellied piranhas. These fish have a fearsome reputation, eating invertebrates, other fish, plus birds, amphibians, reptiles and mammals. They prefer to consume dead or dying prey, but they will attack healthy animals and even occasionally, humans, when food is scarce. In 2011, an 18 year old drunk man was eaten alive by piranhas in the Amazon region, while in the following year, a young Brazilian girl was killed, and



▲ Giant land snails (*Achatina* sp.) are also represented in the collection.

then 40 swimmers were injured by these fish during 2013 in Argentina.

The reptile house

Once inside the reptile house, the first creature that we encountered was an emerald tree monitor (*Varanus prasinus*). This lizard from New Guinea eats insects, small mammals, birds and other reptiles. He was remarkably active. In fact, all the animals were moving around, and generally doing what reptiles do. There was very little sleeping going on.

The Utila spiny-tailed iguana (*Ctenosaura bakeri*), whose distribution is restricted to the island of this name that is located off the coast of Honduras, was the species that we spotted next. These lizards eat plants and insects. They are endangered in the wild and are very strictly protected, in an attempt to try and save the species from extinction.

Hunting and habitat loss have pushed it to the brink of extinction. Competition with the larger black spiny-tailed iguana (*C. similis*) has led to hybridisation in some areas, with the remaining population of Utila spiny-tailed iguanas now restricted to mangrove forest occupying an area of just 8sq km (3.1sq ml) in area.



The island on which the Utila iguana is found in the wild is shown here. Map courtesy rbrausse, IUCN Red List of Threatened Species, species assessors and the authors of the spatial data.

Next we spotted the Morelet's crocodiles, with some hatchlings in an adjacent pen. This species is one of the smaller crocodylians, growing to a length of about 3m (10ft). It is named after the French naturalist, P.M.A. Morelet, being first discovered by him in Mexico back in 1850. Morticia, the adult female in the collection, and her partner Gomez have proved to be very compatible. Being only in their early teens, so they could breed successfully for many more years. Their incubated eggs hatch after a period of roughly eighty-five days under the watchful eyes of James and his team.

Snake killer spotted



These armadillos use their body armour in combat with snakes.

Leaving the warmth of the Invertebrate House, we saw a six banded armadillo in its pen, as we headed on to return to tropical heat in the Reptile House. This species, which is native to Brazil, Uruguay, and Argentina, is active during the day, hunting for live prey or browsing on plant matter.

I've seen armadillos run, and they don't half move, although this one was having a leisurely snooze. Incredibly, they are equipped to kill snakes very effectively, using the edge of their hard body casing to slice into the reptile's body, with fatal consequences.



An emerald tree monitor. Note the sharp claws that help this species to maintain its balance off the ground, and can also help it to seize prey.



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A selection of the species to be seen

1 The Fiji banded iguana (*Brachylophus fasciatus*) is endangered in the wild on its native islands in the South Pacific – including both Fiji and Tonga – because of habitat destruction and the introduction of the mongoose and domestic cats, which prey on them there. These lizards naturally forage by day and retreat to the treetops in search of safety at night.

2 A rhinoceros iguana (*Cyclura cornuta*) showing the so-called 'horn' on its head that is responsible for its common name. It comes from the Caribbean island of Hispaniola, which consists of the countries of Haiti and the Dominican Republic. These are vegetarian lizards and are unfortunately endangered as the result of habitat destruction by feral goats, and the introduction of cats, dogs and rats many years ago.

3 The Amazon milk frog (*Trachycephalus resinifictrix*) is a very attractive amphibian from tropical South America. It preys on insects and lives in tree cavities. These frogs produce a white poisonous substance when threatened, hence their name. Females can lay up to 2,500 eggs at a single spawning.

4 The crocodile monitor (*Varanus salvadorii*) comes from New Guinea and is one of the largest lizards in the world, reaching over 2.4m (8ft) in length. It lives in the trees although it may sleep on the ground or even in water. This lizard hunts by ambushing prey including mammals and birds, and also feeds on eggs and carrion.

5 The bearded dragon (*Pogona vitticeps*) is a particularly handsome lizard, although possibly because they are so common and widely kept as pets, so it is easy to overlook this fact. The male's throat area may turn black during courtship, and when threatened, this 'beard' of spines can be erected to ward off predators. They are native to Australia.

6 The red tailed racer (*Gonyosoma oxycephalum*) is a ratsnake originating from south-east Asia. It is largely arboreal, venturing through the trees in search of birds and their nests, although it is also known to prey on bats and small rodents. It ranges over a wide area, and there are several localised colour variants recognised from the wild.

7 The Mexican beaded lizard (*Heloderma horridum*) is one of only two venomous lizards in the world, with the other being its relative, the gila monster (*H. suspectum*). They feed largely on eggs, and the reason for their venom is unclear. This is being used in medical research, however, for scientists in search of a cure for *diabetes mellitus*.

8 The frilled dragon (*Chlamydosaurus kingii*) lives in trees in Australia and New Guinea. It hunts insects and small vertebrates. It exposes its large frill and the colouring in its mouth if alarmed, so as to disorientate would-be predators.

9 Hermann's tortoise (*Testudo hermanni*) is a common pet, now being widely bred. These tortoises originate from southern Europe, and feed on vegetable matter. They can orientate themselves very effectively around their territory, and may live for over a century.

10 The Jamaican boa (*Epicrates subflavus*) is confined to the Caribbean island of Jamaica, and is currently regarded as vulnerable, because of habitat changes and predation by introduced mammals. Sugar plantation workers also kill these snakes because of a misplaced fear that they are venomous. Jamaican boas have a very distinctive yellowish head and can grow to 2m (6.75ft) long.

11 The African bullfrog is native to sub-Saharan Africa and is one of the largest amphibians in the world. It preys on small mammals, birds and reptiles and is a voracious predator.

12 The blue-bellied eastern fence lizard (*Sceloporus undulatus*) lives in rocks and is also often found amongst woodpiles in the eastern United States. In some areas, these lizards have grown longer legs, probably to help them escape from red fire ants, which are capable of killing them very rapidly.





A selection of the species to be seen cont.

13 The mangrove snake (*Boiga dendrophila*) is another south-east Asian species, and can grow up to 2.4m (8ft). It is a rear-fanged colubrid, and although its venom can have nasty side-effects, usually causing severe swelling at the site of the bite, it is not deadly to people. This species is also called the gold-ringed cat snake because of its appearance.

14 The green anaconda (*Eunectes murinus*) comes from tropical areas of South America and the species can also be found on Trinidad. It is believed to be the world's heaviest snake, and can reach at least 5.21m (17.1ft) in length – and could grow bigger still. Their power makes these anacondas formidable predators, and they have even been known to prey on large caimans.

15 The reticulated python (*Python reticulatus*) from south-east Asia grows to a larger size than the green anaconda, reaching a length of 6.95m (22.8ft). This makes it not just the world's largest living snake, but also the world's longest living reptile. These snakes can swim very well, and have been found far out in the ocean, explaining why this species is represented on many of the islands in the part of the world where it originates. Its name 'reticulatus' refers to the web-like patterning on its body.

16 The puff adder (*Bitis arietans*) is most likely to be found in grassland areas across Africa, and is an ambush hunter, seizing unwary prey such as rodents that come within reach. It is essentially nocturnal by nature, but even so, this species is believed to be responsible for causing more human fatalities than any other species. Female puff adders give birth to live young and litters of over 80 have been recorded.



Plan a visit



Cotswold Wildlife Park is located approximately 3.2km (2ml) south of Burford, midway between Oxford and Cheltenham on the A40. For satellite navigation purposes, set the destination postcode to OX18 4JP. The collection is open every day of the year (apart from Christmas Day) and opening times over the summer, through until November, are from 10am to 6pm, with last admissions at 4.30pm, although the Madagascar exhibit closes at 3.30pm.

Ticket prices are £15 per adult (£14 if purchased as an e-ticket), with admission for children (aged 3-16) and senior citizens being £10 (£9.50 as a e-ticket). Season tickets are available as well. Admission for under 3s is free. More information and e-tickets can be purchased at <http://www.cotswoldwildlifepark.co.uk/plan-your-visit/admission-tickets.htm>

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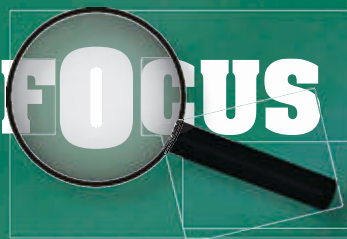


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AMPHIBIAN FOCUS



Cave salamander (*Eurycea lucifuga*)

Rather confusingly, there are a number of different salamanders that have become known as cave salamanders, simply because this is where they tend to be found. Some are much more specialised than others, with the olm (*Proteus anguinus*) being encountered deep within this subterranean world. Occurring in southeastern parts of Europe, it is both blind and unpigmented, displaying the typical features associated with creatures found in this type of environment.

The cave salamander seen here, however, does not fit into this category, despite what its name might suggest. It lives in North America, frequenting limestone areas mainly in south-central parts, and was one of the first members of the group to be studied. This species can often be found at the entrance to caves, or even out in the open, in forests and damp areas generally, where it could be caught quite easily.

This enabled a French biologist called Constantine Samuel Rafinesque to carry out a detailed study on this species and its lifestyle back in 1822, while a professor at Transylvania University, in Lexington, Kentucky. Local people at that stage referred to it as the cave puppet, probably because of its elongated body shape. It is a lungless salamander, and so effectively 'breathes' through its skin and the tissues lining its mouth.

These amphibians display no signs of loss of pigmentation. In fact, the marked contrast between the spots on the body and the underlying colouration here has led to this species also becoming known as the spotted-tailed salamander.

Individuals can grow to 20cm (8in) long, with as much as two-thirds of their body length being accounted for by their tail, which is prehensile and so can be used for grasping. Unusually, courtship occurs in late summer, with the eggs being laid singly in secluded areas of water over the winter. A single female may produce as many as 120 in total.

The resulting tadpoles then feed on invertebrates and will metamorphose, emerging on to land anywhere from 6-18 months later, depending partly on where they occur in the wild. Their depth of red colouration also varies too, being influenced by their locality.

Further information

Want to know more about this group of creatures and their care? Then order a copy of our special guide to amphibians today. See page 3 for further details.

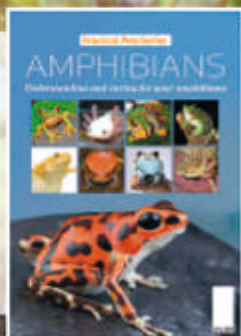




Photo courtesy Hargle on
English Wikipedia.

CHOOSING

snakes or lizards?



Starting out with a new species is always exciting, but it is important to focus on their individual requirements at the outset, in terms of narrowing your choice, as Don Harper explains in this article, which concentrates on those that are most popular in the hobby today.

One major area of distinction that sets acquiring a pet reptile apart from choosing a cat, for example, is that the accommodation needs of reptiles can differ quite widely between the various species. It is therefore very important to make your choice, before purchasing equipment. There are also significant dietary differences to bear in mind that may play a part in your decision.

Snakes

As snakes are not social by nature, so they are kept on their own. It is important to remember that some snakes such as boa constrictors (*Boa constrictor*) spend their time off the ground, and so require a taller enclosure than those that are essentially terrestrial. The vast majority of snakes feed on birds and mammals, and

▼ Garter snakes will feed on earthworms, and also hunt amphibians and fish in the wild. They can be fed differently to most snakes, but you need to think about supplementation carefully.

some prey on others of their own kind, as well as lizards and fish.

Very few snakes, relatively speaking, hunt invertebrates, and surprisingly, those that do are relatively hard to keep. This means that you – and potentially other people in your family – must be prepared to feed snakes on items such as dead mice, rats and day-old chicks which can be brought from specialist suppliers.

Garter snakes are worth considering if you prefer a different option though.

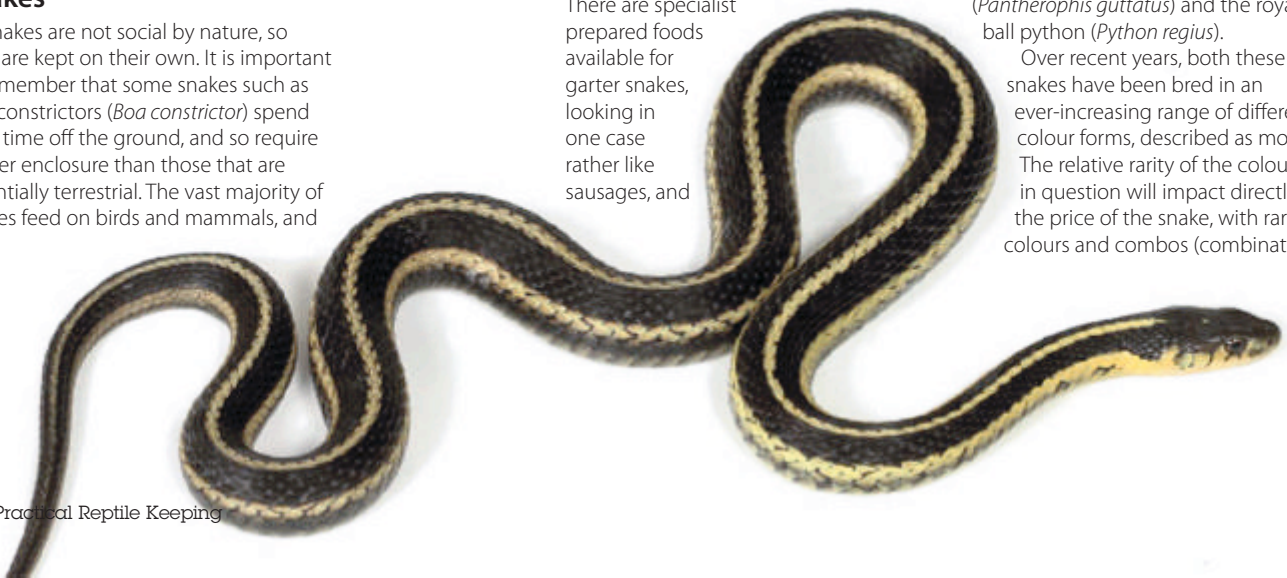
There are specialist prepared foods available for garter snakes, looking in one case rather like sausages, and

they may eat earthworms which can be obtained from specialist suppliers, being safe to use, unlike their wild counterparts. There are no prepared diets available for other groups of snake.

Popular choices

When it comes to snakes, there are two species that are particularly popular with newcomers to the hobby today, although garter snakes could be added to this list. These are the corn snake (*Pantherophis guttatus*) and the royal or ball python (*Python regius*).

Over recent years, both these snakes have been bred in an ever-increasing range of different colour forms, described as morphs. The relative rarity of the colour form in question will impact directly on the price of the snake, with rare colours and combos (combinations)





The height of their enclosure is particularly important for arboreal snakes like the boa constrictor. Heat and light sources must be carefully shielded as well, to prevent them suffering from potentially fatal burns here.



▲ Corn snakes do climb, and so must have secure branches in their quarters for this purpose.

accordance with its body temperature, warming up or cooling down as required, by adjusting its position. Retreats must also be supplied where the snake can hide away, in both warmer and cool areas of its quarters.

The typical "wild" form of the corn snake displays very variable patterning. Its colouration ranges from shades of orange through red to brown and black. This particular patterning is often described in the hobby as the Okeetee, reflecting the typical markings of corn snakes originating from South Carolina.

Many of the most striking colour forms



selling for massive sums of money, especially in the case of ball pythons, because of their genetic potential. Snake cannot be sexed visually, but by means of probing their vent area carefully.

Corn snakes

These snakes occur over a wide area of the southern USA, with their distribution extending southwards across the Mexican border, and the species can also be found on the Cayman Islands. The

temperature range across their quarters should range from 21-30°C (70-86°F), with one end being warmer than the other, thereby creating what is described as thermal gradient.

This enables the snake to adjust its positioning in

► Corn snakes probably rank as the most commonly-kept snake today. They are now being bred in a wide range of varieties.



If you want a snake that should grow up being easy to handle, then start with a young individual, but not a hatchling. You want to be sure that your snake is eating when you acquire it, and some young corns can be reluctant feeders at first.



today lack the dark melanin pigment, as in the so-called "reverse Okeetee", which is an amelanistic variant, which means that all of the black pigment, called melanin, associated with the classic form of these snakes is missing, being replaced by white areas.

The latest development has been the emergence of a scaleless form. The absence of scales has given these corn snakes a more brightly coloured appearance. Ultimately, this characteristic can be combined with all existing colour variants. A scaleless mutation has just emerged very recently in ball pythons too, but such snakes are presently very scarce.

Ball pythons

These snakes are so-called because of the way that they curl up into a ball, and they should be provided with snug retreats in their quarters to help them feel secure. Originating from West Africa, they generally have quite placid natures, making them relatively easy to handle. Never grip a snake's body tightly when picking it up though, as this can cause serious bruising, which may ultimately be fatal. Start by supporting the head.

If you obtain a relatively young snake, and handle it frequently, it will soon become used to this experience. Ball pythons can sometimes be a worry, however, as they undergo periods when they lose their appetite, and refuse food, sometimes for months. It is always worth seeking the advice of an experienced reptile vet under these circumstances, to ensure there is no medical problem to explain the change in the snake's feeding habits.

Retreats are very important for these relatively shy snakes, and the temperature needs to reflect the fact that they come from a tropical part of the world. A temperature gradient of 27-29°C (81-85°F), dropping back just

➤ A group of scale-less corn snakes. This mutation has become very popular, because it effectively serves to brighten the colouration of these snakes.



▲ A ball python revealing why it acquired its common name. These snakes are also often described as royal pythons in the UK.

▼ The blizzard corn snake has a very striking appearance, in spite of its lack of colour. As a red-eyed form, it is particularly important that it can retreat out of the light in its quarters if it wants.

very slightly at night, is to be recommended.

Food must always be of the appropriate size for your snake, so that it can be swallowed easily, and defrosted thoroughly at room temperature before being offered to the snake. Offering food on special blunt-ended forceps may encourage the snake to strike, if it is waved around to stimulate movement.

Snakes will always lose their appetite when they are about to shed their skin, with the area over their eyes becoming milky. Keep the humidity up in their quarters at this stage, and it can be helpful to provide a damp, moss-filled

retreat to assist this process too.

If the covering over the eyes does not revert to normal, this means that the so-called 'spectacles' have been retained, and you should seek veterinary advice. Snakes do not have eyelids as such, as their eyes are covered with skin, which is a key point of distinction with lizards. Low humidity in the snake's quarters at this stage is the most common cause of shedding problems. Offering a suitable bath can help to overcome this problem, but you may also need veterinary advice, especially if the skin over the eyes is retained.

There are now many different colour morphs existing in the case of ball



A tiger ball python. Colour morphs can rank amongst the most expensive of all snakes, selling for thousands of pounds, so just because you like a particular colour does not mean it will be within your price range!



▲ *Uromastix* like this Nigerian red individual are unusual amongst lizards in feeding mainly on vegetable matter. The diets of those that feed on invertebrates must be supplemented as well.

pythons, with some being considerably more expensive than others. Their care is basically identical though, but beware of spider ball pythons. They can be affected by a neurological disorder, which may be severe in some cases.

Lizards

Always remember that effective UV lighting is especially vital for this group of reptiles, in order to ensure that they are not at risk from a deficiency of Vitamin D3, which is a cause of the preventable (and potentially fatal condition) known as metabolic bone disease (MBD). They can be divided broadly into two groups. There are those that feed on invertebrates, and a relatively few, such as *Uromastix* (*Uromastix* species) that eat predominantly vegetable matter.

It is vital to be aware of the adult size to which a young lizard is likely to grow, as some, such as green iguanas (*Iguana iguana*) and Nile monitors (*Varanus niloticus*) can attain lengths of a metre (3ft) or more. This means they can be difficult to handle, with sharp claws, teeth and a powerful tail, as well requiring very large enclosures at they grow larger.

Many lizards should be regarded as pets to observe, rather than handle, but there are exceptions, notably in the case of the bearded dragon (*Pogona vitticeps*), and its lesser-known relative, called Rankin's dragon (*P. henrylawsoni*). These lizards can become incredibly tame, and may be allowed out of their quarters on a regular basis.

They will come to recognise you, and bob their heads up and down as a greeting, as well as feeding readily from your hand. There are now a number

of different types of prepared food that are specially formulated for these particular lizards, which makes their care more straightforward, although a varied diet is beneficial.

A wide selection of different morphs of the bearded dragon are now available, generally being more colourful than the wild brown form, while the silkback form has a smooth body. Bearded dragons grow to approximately 45cm (18in)

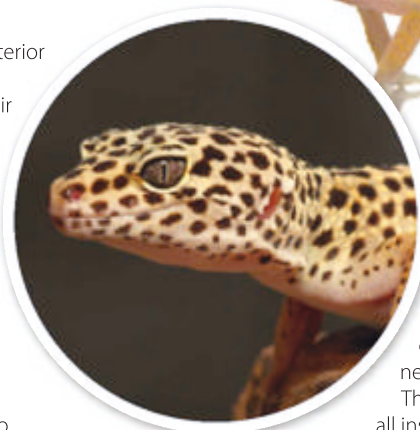
overall when adult.

Originating from the interior of Australia, they need to have a basking area in their quarters, and UV lighting. There should be a daytime hot spot at one end of their quarters of approximately 31°C (88°F), with the enclosure dropping down to about 24°C (75°F) at night.

Leopard geckos

Two other lizards have also established a widespread following as pets over recent years. They are both geckos, but with quite different lifestyles. The leopard gecko (*Eublepharis macularius*) is a native of the arid landscape of Pakistan and Afghanistan. It is a crepuscular species, meaning that it becomes active at dusk, and is so-called because of its spotted patterning.

These geckos require an arid style of vivarium, with plenty of hiding places. Geckos as a group generally have enlarged toe pads, enabling them to climb well, but this species does not



▲ Leopard geckos develop their spotted patterning as they mature – young individuals are banded.

▼ There are a number of different colour forms of the bearded dragon now being bred. Orange variants are popular.

display this characteristic. Nevertheless, these geckos are still very agile, and should not be encouraged to roam unsupervised outside their enclosure, as they can prove to be a problem to recapture once loose in a room. They can attain an overall length approaching 30cm (12in).

Leopard geckos, or “leos” as they are often described in the hobby, have now been bred in a huge range of colour forms. It is probably not a good idea to choose the enigma form, as geckos of this type can sometimes develop neurological problems.

Their diet is very important – as with all insectivorous lizards – to guard against the risk of metabolic bone disease (MBD). All invertebrates such as crickets offered to them should be gut-loaded, meaning that these will have received a special enriched diet, including plenty of calcium.

Any deficiency of calcium in the diet can also be a cause of this illness, quite ➤



apart from a vitamin D3 deficiency. This is because vitamin D3 regulates the uptake of calcium in the body, helping to ensure a healthy skeleton. It is also generally recommended to use a powdered supplement to sprinkle over live food such as crickets as well, because invertebrates in general have a relatively low calcium content.

Crested geckos

The other popular lizard, which has undergone a remarkable transformation in its numbers over recent years, is the crested gecko (*Rhacodactylus ciliatus*). It was actually believed to have gone extinct, until its rediscovery as the result of a tropical storm in 1994. It originates from the island of New Caledonia, in the Pacific Ocean.

Now however, it has become immensely popular in a short space of time, thanks partly to its attractive appearance. Some colour variants are being recognised, and those that have spotted patterning are described as Dalmatians, corresponding to the well-known spotted bred of dog.

This is a forest-dwelling species, and very adept at climbing. It uses not just all its feet, equipped with enlarged, striated toe pads that help it to maintain a grip on vertical surfaces, but also its tail. Crested geckos therefore require a different type of set-up to a leopard gecko.

You need a tall vivarium, incorporating live or artificial plants,



Crested geckos can use their tails in order to help support themselves.

Unlike the leopard gecko, the crested gecko has enlarged toe pads, that help it to climb vertical surfaces. Its slit-shaped eyes reveal that it primarily nocturnal in terms of its behaviour.



enabling a crested gecko to be able to climb around its quarters. There are plenty of attractive artificial options available these days, and they are much easier to maintain than living plants in this situation.

In terms of temperature, these geckos do not like to be kept too warm. A figure between 22-26°C (72-80°F) will be ideal. Although coming from a forest environment, they do like to bask, and so their quarters should incorporate a weak UV source, as with leopard geckos. Choose a light with a 2.0 rating. This reflects the amount of UV that it emits, in percentage terms.

It is usual to leave this light on for a period of time in the morning, and again in the evening, as these lizards are also more active at night, as reflected by their vertical, slit-shaped pupils. Their colouration can also change quite dramatically, depending on the lighting.

You need to spray their quarters at least once a day, partly because they will drink from the water droplets. Spraying is

particularly important when they are shedding their skin – if conditions are too dry, the old skin may be left around their toes, ultimately constricting the blood supply here, resulting in a loss of the affected digit(s). Check the humidity with a hygrometer. It can rise to 80% or more, but let it fall back to 50% on occasions, so that the vivarium is not constantly wet, as this will trigger fungal growth.

Crested geckos need to be handled carefully, because they can lose their tails, like many lizards. Always avoid holding them by this part of the body. Nevertheless, they are quite friendly lizards, and can be tamed to sit on your hand quite easily.

There are also special foods now available for crested geckos, so there is less reliance on invertebrates, compared with leopard geckos. These formulated diets are more balanced, in terms of their calcium level and other key ingredients. Ripe fruit such as banana is also appreciated, but always remove any left-over fruit before it can turn mouldy. ❖

These geckos can use their remarkable tongues to lap up food such as ripe banana. Special diets are available for them.



Out of Africa

Life in water



In this last instalment of his series examining how reptiles have adapted to different environments, Paul Donovan focuses on how members of this group have successfully adopted an aquatic lifestyle.

It's said – with justification – that water is life's necessity. Without it, there would be no life. And the life that it supports is varied in the extreme; from micro-organisms to giants such as the blue whale, which is the world's largest and heaviest animal, providing proof of the fact that living in water frees animals from the size constraints that exist on land.

And of course, various reptiles are to be found in amongst these aquatic life forms. This ancient group has colonised just about every conceivable type of

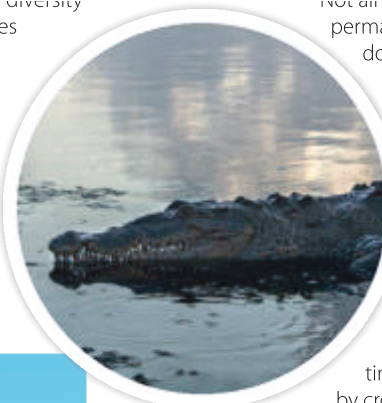
habitat imaginable, and done so with great success. Nevertheless, the diversity that exists among marine reptiles today is significantly reduced compared with the past, when ichthyosaurs and plesiosaurs were seemingly common inhabitants of the world's oceans. However, these creatures were all wiped out about 65 million years ago, along with the dinosaurs, at the end of the Cretaceous period.

Total commitment?

Not all reptiles live in water on a permanent basis – in fact, the majority do not, alternating their time in water with their need to sunbathe, obtaining crucial warmth and Vitamin D3 by basking. Reptiles are often classed as being either permanently aquatic (living in water all the time, as in the case of sea turtles) or semi-permanent, which means that they regularly alternate time in the water with time spent on land, as exemplified by crocodiles.

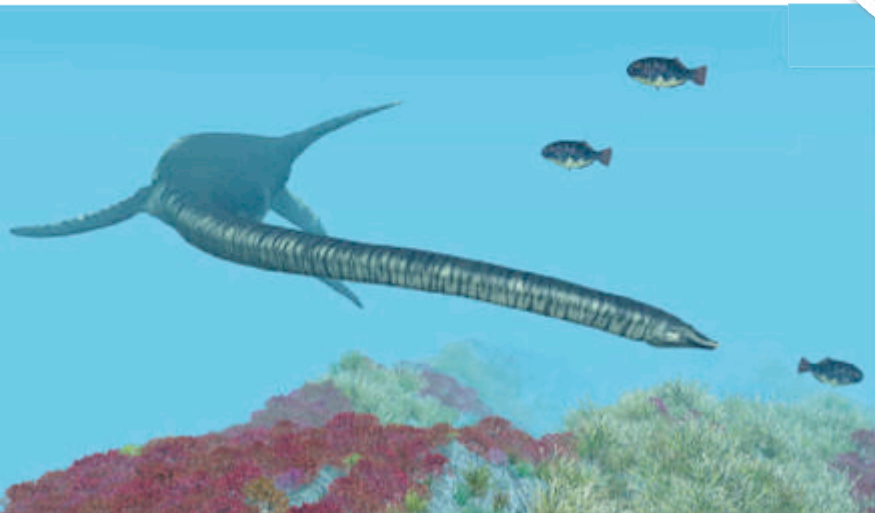
Nevertheless, just about any reptile, if it finds itself in water, has the capacity to swim. This is a reflection of a combination of their basic body plan and large lung(s), which help to provide buoyancy. It is worth remembering that chemically, not all water is the same; there is freshwater, brackish water and saltwater. Generally, although those reptiles that have an aquatic lifestyle will frequent a particular type of water, there are some that can live in these different aquatic environments with surprising ease.

In spite of its names, the saltwater or estuarine crocodile (*Crocodylus porosus*) is a case in point. It represents something



▲ The American crocodile (*C. acutus*) is another species that may enter the sea.

◀ Aquatic reptiles used to be more common than today, and included extinct groups such as marine plesiosaurs.



of a throwback, given that most of the world's crocodilians are now to be found in freshwater. In the past, gigantic marine crocodilians used to inhabit the world's warmer oceans, although they are now all extinct, represented only in the fossil record.

Breathing

Many aquatic reptiles have their nostrils positioned high on the head. This allows them to remain submerged but still breathe without having to raise their head out of the water. Of course, one of the problems with living an aquatic lifestyle is having the mechanism(s) to prevent yourself from drowning. As soon as you place your head beneath the surface, water could rush into your respiratory system.

Obviously any life form adapted to living in a particular ecosystem will have developed means of overcoming some of the difficulties presented by that environment, and this is true with aquatic reptiles. Crocodilians have a flap of skin at the back of the throat called the palatal valve that can close off their windpipe and alimentary tract. The nostrils are also furnished with a valvular closing system, as are the ears although they have nothing to do with respiration, of course.

▼ A crocodilian can remain submerged literally for hours.

Photo courtesy of the author.

Softshelled turtles (*Trionyx species*) may breathe through their cloaca when in water, and they are also equipped with the snorkel-like projection on their nostril, enabling them to breathe without surfacing, especially in shallow water.



The snake's glottis is plugged into the opening of the nasal passage - in much the same way as a cork in a bottle, rendering the system watertight. Once the respiratory system is locked, however, then comes the problem of being able to utilise the air in that system to keep yourself alive. This means the lungs must be more efficient at absorbing oxygen and dealing with carbon dioxide in order to allow the animal to remain submerged for extended periods of time.

When we dive beneath the surface, we take a deep lungful of air and hold our breath. Contrary to what might be expected, this is not how aquatic reptiles go about things. In fact, they may display a complete reversal of this method, as will become clear. In the case of true aquatic snakes such as sea kraits and sea snakes, these have a proportionally longer lung than their terrestrial cousins. In some cases, it can extend for over a third of the body length, and is more specialised too.

Sea snakes and kraits also possess a

muscular saccular region posterior to the lung which forces air into the forward vascular region, where oxygen can enter the blood, and carbon dioxide leaves. Aided by these anatomical modifications, these particular reptiles can remain submerged for up to two hours at a time.

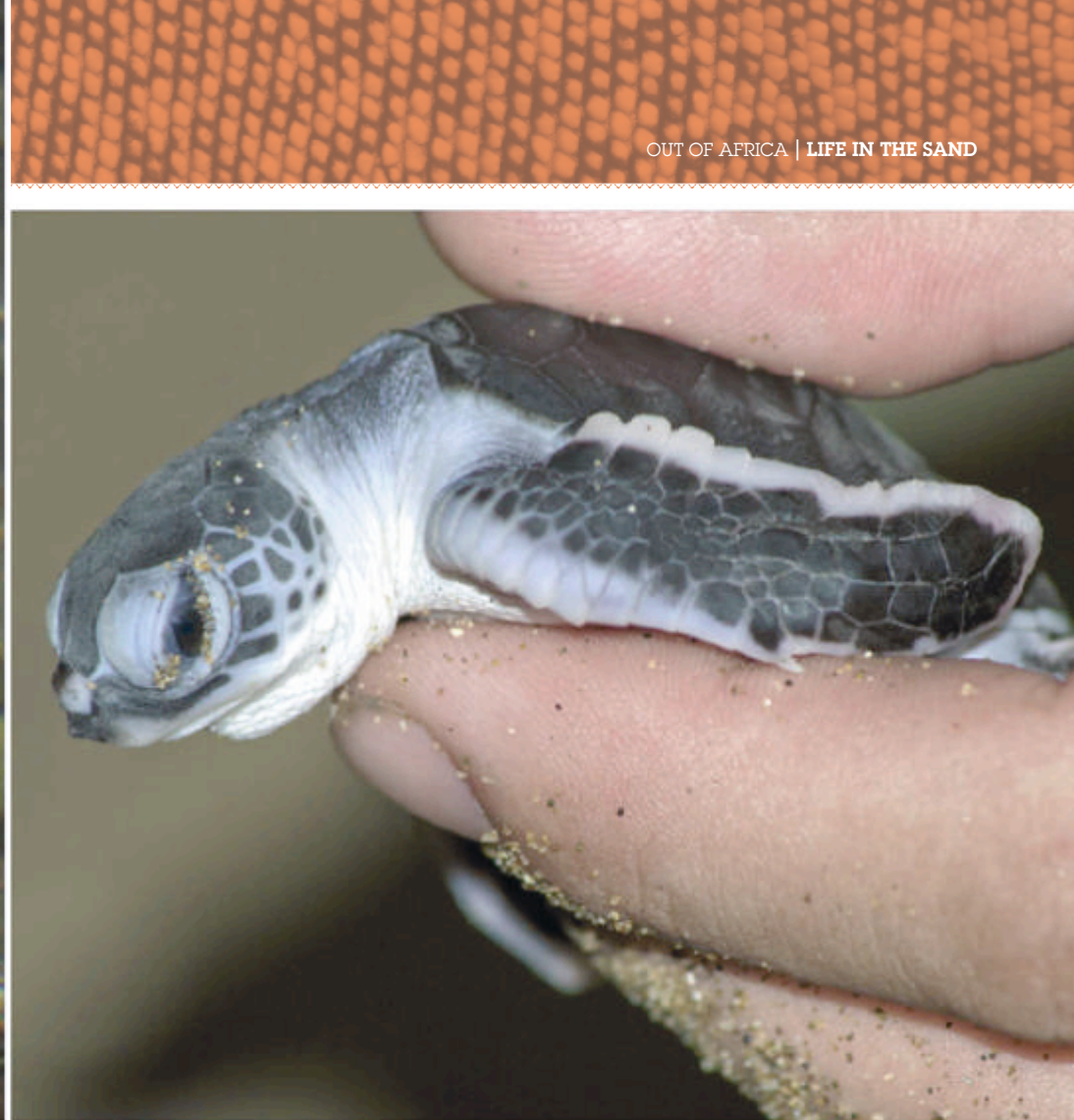
In crocodilians, however, things are quite different. They actually exhale air from their lungs to achieve neutral buoyancy. If they took a gulp of air, they would find it extremely difficult to dive, and instead, they would be more likely to end up floating around at the surface like a balloon.

Crocodilians also slow down their heart rate, from around 15-20 bpm (beats per minute) to 2-3 bpm so they can utilise the air that remains in their lungs as efficiently as possible. This means less blood is being pumped around the body, which in turn requires less oxygen.

As the heart rate slows down, valves come into play that then redirect blood only to those essential areas of the body, such as the brain. The blood also has an affinity to carry higher levels of oxygen, making oxygen uptake more efficient. In this sedentary mode, a crocodilian can remain submerged for several hours. I

Crocodilians have a flap of skin at the back of the throat called a palatal valve. This closes off the windpipe and digestive tract, preventing water entering here. Photo courtesy of the author.

■ I think the longest recorded submergence to date was that of a saltwater crocodile which remained underwater for three hours. ■



▲ In some turtles, the toes have been transformed into more efficient flippers.

◀ Water monitors swim in a similar way to crocodiles.

think the longest recorded submergence to date was that of a saltwater crocodile which remained underwater for three hours.

One of the most bizarre mechanisms of being able to survive submerged must surely be that seen in some species of turtle, which can absorb oxygen through their cloaca, at the rear end of their digestive tract. Expanding and contracting the cloacal muscles forces water in and out of this part of the body like a pump. The cloacal area is richly supplied with blood vessels through

which oxygen from the water may be absorbed. Some freshwater turtles can also absorb oxygen into the bloodstream through the pharyngeal region of the throat.

Movement

Movement through the water comes easy for reptiles; often more so than it does on land, certainly for turtles. The sinuous undulations of the snake's body propel it effortlessly through the water, with added impetus being gained through the tail. In marine snakes, the tail

has undergone some modification, in that it has become vertically compressed to provide a greater surface area to the water. It thus functions like that of a fish's tail, helping to give propulsive thrust and acceleration when necessary.

Crocodiles and alligators tuck their legs tightly against their body, forming themselves into a more streamlined torpedo shape, with the propulsive thrust coming from the movement of their huge muscular tail. Monitor lizards, a number of which are semi-aquatic, swim in a similar way as well.

Turtles have perhaps the most elegant method of swimming out of all reptiles. Their feet can be webbed, providing greater surface area to move through the water as they paddle, rather like ducks. Alternatively, they may be modified into flippers that sweep them along through the water, in what particularly in marine species can resemble an almost effortless movement.

The carapace of aquatic turtles or terrapins also reflects their aquatic lifestyle. While land-based tortoises tend to have, in most cases, a relatively high domed shell, their aquatic cousins have a more flattened shell, for a number of reasons.

First and foremost, it is more streamlined for swimming purposes, creating less water resistance and drag, which would slow the turtle down. It is also lighter, meaning swimming takes

reduced effort and requires less energy, as well as providing greater stability.

A high, domed shell would not only make the turtle inherently top heavy, but would create buoyancy problems as well, making it difficult for the turtle to submerge. It would be like trying to dive beneath the water wearing a buoyancy aid – the turtle would tend to keep popping back up to the surface again.

Underwater vision

Of course, it's all well and good being able to submerge and have the means of propelling yourself through the water. However, if you cannot see where you are going, you will be at risk of bumping into objects in your path, and also not being able to spot predators that can creep up on you easily under these circumstances.

Fortunately, aquatic reptiles have found answers to these problems as well. In crocodilians and turtles, this takes the form of a third eyelid, known as the nictitating membrane. This clear membrane sweeps across the eye, protecting it whilst allowing the animal to still see; it rather like a diver wearing a pair of goggles. Of course, snakes do not have this problem though, because they have a permanent scale covering the eye, called a brille.

Senses and prey

Despite the restrictions that living in water places on aquatic reptiles, they have all the speed, agility, cunning and hunting capability necessary to ensure their survival. Marine iguanas (*Amblyrhynchus cristatus*) from the Galápagos Islands have continued with the predominantly vegetarian lifestyle of their ancestors however, but now they browse on marine algae.

The tongue is the snake's major sensory organ, providing the means to allow it to detect prey, determine from which direction it is approaching, and also to detect the pheromones of sexually responsive females. In a watery



▲ Aquatic chelonians have flatter carapaces than their land cousins.
Photo courtesy of the author.

environment, this sensory system is far less effective than on land. As a result, in truly aquatic snakes such as the kraits and sea snakes, the tongue has become much shorter than in terrestrial snakes, and only the forked tip is protruded through a divided notch in the upper lip, rather than the entire tongue.

Living in water poses other difficulties too. In a large area of the ocean, prey can be extremely difficult to catch, and then once caught, you need to be able to ensure that you can hold on to it, to prevent it from escaping. When it comes to fish, this can be very difficult; they are fast, slippery, and potentially strong. This is the reason that marine snakes have developed potent fast-acting venom that they can employ to subdue their prey.

If you can have all of your senses still working, even though virtually all of your body is concealed beneath the water, you are at an advantage when it comes to stalking your next meal. A number of aquatic reptiles are well known for this ability, not least the green anaconda and crocodilians.

Both show similarities as to how they display the same trait. With the anaconda, its head is held out of the water at an angle which exposes the nostrils and eyes. The crocodilian remains in a position where its head is parallel to the water's surface. The ears, eyes and nostrils are placed so high on the head that all these key senses can still be employed to

deadly effect, while the crocodilian itself remains hidden, creating the advantage of stealth.

The ultimate stealth hunter

Stealth hunting exists in a number of forms, but one of the most cunning must surely be that employed by the alligator snapping turtle (*Macrochelys temminckii*). This large cumbersome turtle would simply not have the speed or dexterity to chase after and catch a fast moving fish, so it has adopted the more casual approach of sit and wait for the fish to come to it. Of course, you could be waiting a very long time, as most fishermen will tell you, so to speed things up, why not offer the unsuspecting victim the impression that it has just chanced upon a tasty morsel of its own?

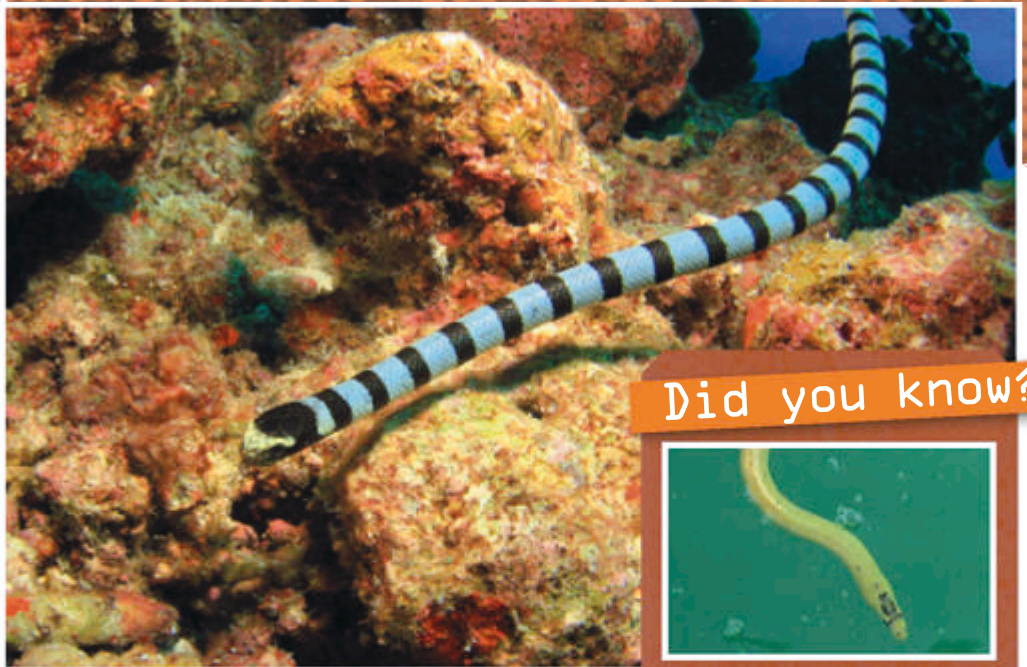
Relying on its amazing camouflage, the alligator snapper lies motionless on the bottom of the lake or riverbed with its mouth agape. A tiny pink slither of skin wriggles from side to side in an apparently empty, harmless void. To an inquisitive fish, this piece of skin resembles a juicy worm and it is just too good a temptation to pass up.

Two tiny beady eyes are keeping a watch on the fish's every move, and when it gets within range or actually enters the mouth itself, two bony jaws come slamming down on the fish. This represents a grizzly end for a fish on the lookout for something to eat, but it

▼ When an anaconda is submerged, its head is held out of the water at an angle which exposes the nostrils and eyes.
Photo courtesy of the author.



■ ■ With the anaconda, its head is held out of the water at an angle which exposes the nostrils and eyes. ■ ■



Did you know?



The yellow-bellied sea snake (*Pelamis platurus*) shown here is the only true pelagic (meaning 'open ocean') snake. However, cold water around the tips of both South America and Africa, in combination with a lack of salinity in the Panama Canal, have acted as a barrier preventing these sea snakes from gaining access to the Atlantic Ocean. Otherwise, this species would have the widest distribution of any living reptile.

▲ Sea snakes have a special gland to help them to control their salt levels.

semi-permeable, allowing the passage of water into the body more easily than would normally be the case; this is the same principle that we have adopted in the manufacture of breathable waterproof jackets - only the other way around.

Equally, when the snake catches its prey, so salt will invariably be consumed too. If the reptile had no means of regulating the level of salt in the body, this would quickly accumulate to a potentially lethal level. Sea snakes have evolved a salt gland encircling the tongue sheath in the floor of the mouth. As the tongue is extended, so excess salt is then expelled. In the case of marine iguanas, they have overcome the challenge of living in a marine environment have special salt glands around the entrance to the nostrils, and regularly expel it by 'snorting' particles out.

Sea turtles also have a mechanism for regulating salt, by excreting the excess through their tear ducts. The saltwater crocodile is unique amongst reptiles, in utilising its blood system to regulate salt levels in the body. If the crocodile is in the sea, where the salinity will be high, so glands at the rear of the tongue called lingual glands excrete superfluous salt once it rises above the required level within the body.

Reproduction

The various reproductive strategies of aquatic reptiles could warrant an article on their own, but suffice to say here that mating takes place in the water. In the case of the so-called 'viviparous' species, such as sea snakes, which give birth to live young, they do so by coming up to the surface and giving birth.

Those species, such as marine turtles, which do lay eggs will come ashore briefly after mating. They dig a nest in the sand, deposit their eggs, covering them over and returning to the water, leaving the eggs and hatchlings to their fate. The young turtles must dig their way out in due course and try to scurry down the beach safely in order to reach the sea.



▲ The use of a baiting technique as seen here, is unique to the alligator snapping turtle. Photo courtesy of the author.

provides an easy meal for the turtle. Interestingly, the use of this "baiting" technique is unique to the alligator snapping turtle, and is not associated with any other species.

The problem with salt

The fundamental problem for reptiles living in saltwater is having the ability to deal with the accumulation of salt in the body. Fluid loss is of particular concern for marine reptiles, so when they absorb saltwater, they need the ability to separate out the salt, to prevent themselves ultimately becoming fatally dehydrated.

There are a number of ways in which this can be achieved. Marine elaphids, for example, achieve this via a novel head gland and skin modifications. The skin is

► The young sea turtles then have to head down to the ocean unaided in due course.

Crocodylian species construct a nest on land from vegetation in which the eggs are laid, with the site then being protected by the female. She will subsequently help the young out of the nest and carries them to water in her mouth, watching over them at first.

Tail-end

Those species that live in water, whether truly aquatic or semi-aquatic, are incredibly well adapted to cope with surviving in this medium. Water is actually a very unsympathetic environment that places a very specific set of challenges on those reptiles that have chosen to make it their home. It is interesting that representatives of every group of reptiles - albeit in small numbers - have managed to do so successfully, confirming the adaptability of the group as a whole. ❖





DO YOU NEED A HELPING HAND OR ADVICE?

Email your queries to prk.ed@kelsey.co.uk or write to the address on page 66. A selection of submitted questions will appear here every month, and a prize of Vetark products will be awarded to the writer of the Star Question. Regrettably, replies can only be given through this column, and if you are worried about the health of your animal, seek veterinary advice without delay.

A tortoise living outdoors



I have been told that I can keep my pet Hermann's tortoise outside in my garden in Kent in the summer and that it will not require any further heating or lighting during the year. Is this correct?

People used to keep so-called 'garden tortoises' in this way many years ago. These unfortunate reptiles were purchased for a very small amount of money, and released into the garden to wander around without much if any care or supervision on the part of their owner. They were then encouraged to hibernate over the winter if they survived the summer.

We know that a vast majority of these tortoises did not survive the first year, let alone live successfully for any length of time, in these surroundings. Nevertheless, it has to be said that a very few individuals did, for some reason, adapt successfully to these alien and essentially inhospitable surroundings and are still alive today. I

have one myself that used to be kept in this way, before being passed on to me, and has been in the country for at least 50 years old.

Things changed dramatically, starting back in 1984 however, when the trade in these wild collected Mediterranean tortoises was banned. Instead of adult tortoises, the focus switched to captive-bred hatchlings, and allowing them to roam was not an option – not least because they would be capable of disappearing very easily.

Working out the parameters

In terms of the adequate provision of heat and light, we have to look at the weather patterns of the country or even the localised terrain where a species originates, and also what stage in the day it is active. It is then possible to formulate an idea of the average temperature that is required, and of course, the required ultraviolet index.

We should look at day length in the habitat in question, and any seasonal changes as well. We can look at breeding seasons and even the diet and mineral content of the soil. This level of

research will reveal the secrets of whether or not your chosen reptile will thrive, as opposed to just surviving.

In terms of your tortoise, we have to look at its core requirements and then assess if the UK can meet them. From my research I would have to say no, our environment here does not provide all that a Hermann's tortoise needs to thrive long term. Why do I say this?



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Firstly, as we all know, we tend to have often rather short and sporadic summers. We may be able to count on around 5-6 weeks of hot sunny weather a year. We can also see that the temperatures here in the UK fall far short of those that occur within the wild range of these tortoises, which is much closer to the Mediterranean. Summers in their native lands last significantly longer than those we have here, and the average wild ultraviolet index (UVI) in the countries of origin for Hermann's tortoises are significantly higher, quite apart from the fact that summer lasts longer.

If a species has changed and adapted to utilise a thermal gradient that reaches up to around 31°C (88°F) for 4-6 months a year and has an average UVI of 6-8+, then that is the level of energy that it would need to thrive if kept permanently outdoors in your garden. If you relied upon the weather here, your tortoise would effectively be too cold, and this would be detrimental to its long term health and even its survival.

Take advantage of the sun

So what is the answer? There is vast power in the sun! Not even the most advanced UV systems can truly replicate the sun and therefore, if and when it is safe to do so, reptiles normally kept indoors should be allowed access to unfiltered sunlight. This will provide them with exposure to full spectrum light, and specifically more wavelengths than science can currently generate. We must, however, view this as a welcomed supplementary rather than exclusive UV source here in the UK.

The way forward is to keep your young tortoise secure indoors, where it can access a controlled heating system and UV set-up that replicates its wild surroundings for the whole of its usual active season. It can then be placed in the garden in secure housing to enjoy the natural sunlight as and when the weather allows.

The risks

We must also now factor in the greater risk of predation outdoors. Should we be allowing tortoises unrestricted and long-term access to our gardens? I fear that the dangers are becoming too significant. With an increasing urban fox population, that has been documented as preying on tortoises, with foxes capable of causing serious if not fatal injuries, allowing these reptiles to roam free, even during the daytime, is no longer as safe as it was, in many parts of the country. Other animals such as cats can be a hazard, not forgetting birds like herring gulls and corvids too.

There are also the risks of tortoises being stolen from these surroundings, and the fact that they can escape and may stray. I think it would be better

to have enclosures that have locked mesh tops to allow access to the sun in the garden without the risk of harm to the animal. It can be helpful if these pens are moveable, to prevent damage to the grass, and also, to adjust the tortoise's location, depending on the direction of the sun.

Other species can benefit

Nevertheless, many species can benefit greatly from access to our gardens when the weather allows. The new designs of screen enclosures make this easier as well. Water dragons and chameleons can be bought out into the garden as can bearded dragons and other species, provided the weather is warm enough, and there is some protection from the sun in their quarters. Suitable retreats should also be provided, just in case the reptiles feel threatened in these surroundings.

Green iguanas can be housed by day in small aviaries with a heat and light source inside; these can be decorated to provide good perching areas. Even so, it is important not to leave the reptiles on their own – you need to be around, just in case the weather changes dramatically, or a would-be predator comes on to the scene, and ready to intervene.

Species normally living in temperate areas are likely to be more adaptable in terms of temperature fluctuations than those occurring in tropical latitudes, where the temperature range is less marked, both on a daily and a seasonal basis. Overall though, be prepared to work within the limitations of our geographical location and use sunlight as a supplementary rather than the master source of heat and beneficial light for your pet.

*John Courteney-Smith,
Reptile Products Manager, Arcadia.*





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Reptile keeper and veterinary surgeon Dr Tariq Abou-Zahr outlines his thinking on common problems that can affect reptiles, with advice on how they can be prevented.



New thoughts on old problems

As a reptile vet, there are a number of so-called “common conditions” that I see on a regular basis. They are preventable to a greater or lesser extent, yet when they do arise, they all require effective treatment if the animal is to have a healthy long future. Unfortunately, these conditions tend not get publicity these days when it comes to new treatment methods because they are so long established.

They are not considered exciting new topics where significant discoveries and advances can be made. Nevertheless, progress in our understanding of how they may arise and what can be done in terms of treatment should benefit many animals, and help their owners as well.

Snake mites

This is a topic that has been covered extensively in this magazine previously. Quite rightly so – these parasites are a huge problem. I very commonly see snakes that have mite infestations, and in many cases, the owners are fully aware of how the mites came to be on their animals, but not how to get on top of the problem. Usually, they will have purchased a new animal and introduced these parasites to their collection in that way.

This is not always the case though. Sometimes, owners are absolutely dumbfounded and have no idea why

they suddenly woke up to discover the characteristic “poppy seed-like” specks (drowned mites) floating in their snakes’ water bowls. I think it’s very interesting to play detective in these cases, because the mites must have come from somewhere – they do not float in the atmosphere.

Snake mites (*Ophionyssus natricis*) can occur on most reptiles. Although they are particularly common in snakes, I have seen a couple of cases involving bearded dragons recently. In my experience, tracing the problem back, the most common source of snake mites – aside from buying animals or second-hand equipment that has them – is through bagged substrates sold via reptile outlets that also deal in livestock.

The pre-packed, sealed substrates that come straight from the manufacturer are unlikely to cause a problem, but substrates which are bagged at facilities that also import and sell livestock can be an issue. Vermiculite and corncob granules are the two substrates that I have seen bring mites into a collection recently. I tend to buy my own vermiculite in quantity via the horticultural trade as opposed to the reptile trade – obviously making sure it

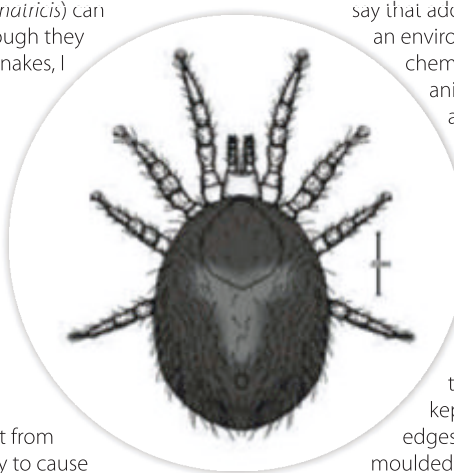
does not have added fertiliser or other unwanted ingredients, but provided you can obtain it from a reptile outlet in a pre-packed form, it should be safe.

Environmental controls

I have been making a study of the treatment of mites recently, and I would say that addressing snake mites is more an environmental rather than a chemical challenge. Firstly, all new animals need to be quarantined and must be kept on a non-particulate substrate.

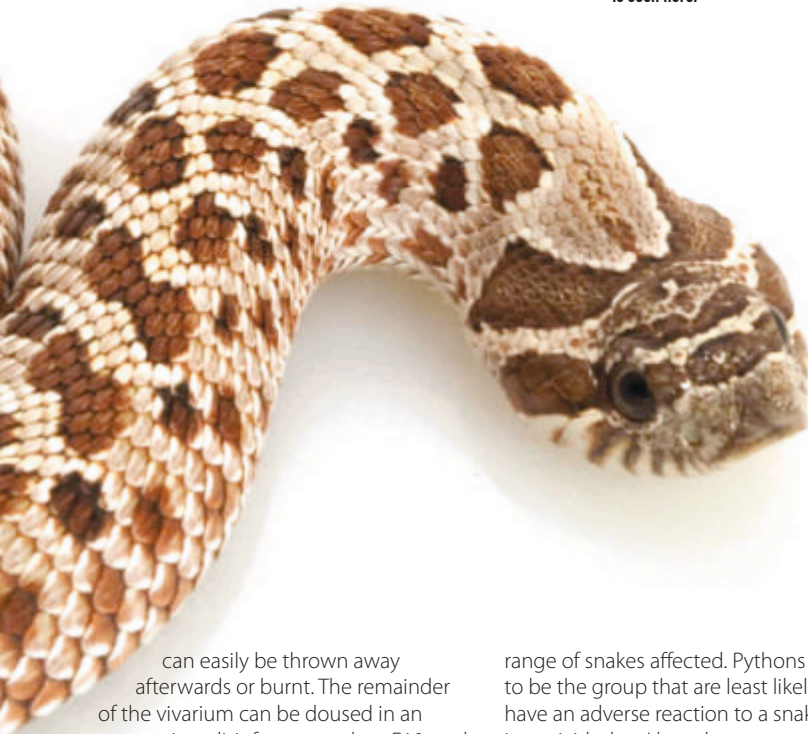
This will allow you to see clearly if the animals are affected by mites at any given time, and also to allow you to get rid of any mites in the environment as rapidly as possible. For this purpose, any animals that have mites should be kept in an enclosure without edges, with vivariums being moulded or sealed so there are no gaps where mites can lurk undetected. Alternatively, the snakes will need to be kept in plastic tubs.

The substrate at this stage should be unprinted newspaper. Unprinted newspaper is available in bundles online (I buy it through eBay), is white in colour and cheap. You will see any mites on unprinted newsprint very clearly and it



▲ A magnified view of a male snake mite. These parasites feed on blood, causing anaemia, and can also transmit infections, including inclusion body disease (IBD). Artwork courtesy Dave and Tracey Barker.

Hognoses are one of the groups of the snakes that can react badly to some mite treatments. A peach western hognose (*Heterodon nasicus*) is seen here.



can easily be thrown away afterwards or burnt. The remainder of the vivarium can be doused in an appropriate disinfectant such as F10, and any mites on the surfaces can be wiped away with paper towels.

A large proportion of mites on snakes can be removed by bathing the snake in water. I do believe it would be possible to rid a snake of mites purely by bathing it and constantly removing mites from the environment, as detailed above, without the need for any chemical or biological mite control. However, it is likely to take longer and is not preferable in many cases (although in some species, it might be the better option – see below). Any decor used in the vivarium must be wiped clean and again, should have no cracks or crevices where these parasites could hide.

I have limited experience with using predatory mites to get rid of snake mites, as I have not found them to be particularly effective. I feel one of the problems is that using this form of biological control makes it difficult to assess the burden of actual snake mites present.

Adverse reactions

This brings me to the subject of chemical control. I have seen a lot of adverse reactions to certain insecticides widely available off the shelf for the control of snake mites. The snakes with adverse reactions typically present seizing, with uncontrolled twitching. It would not be appropriate for me to name any particular products, but one insecticide in particular that is marketed for ridding mites from snakes and their environment is over-represented in the cases that I have seen.

Although colubrid snakes (particularly garter snakes and hognoses) are the snakes where adverse reactions are most commonly documented, I have seen a

range of snakes affected. Pythons seem to be the group that are least likely to have an adverse reaction to a snake mite insecticide, but I have been presented with a number of boas seizing.

In these cases, I usually administer an anticonvulsant drug called diazepam that works in some snakes. In instances where I have been unable to stop the snake seizing by this means, I have anaesthetised it in an effort to prevent the seizures, but with varying success.

There is no effective chemical mite control product that I am aware of where no adverse reactions have been reported. My own personal preference for the treatment of snake mites is the drug fipronil (marketed as Frontline) in spray form. The dosage used is 3-6ml per kg of snake and I would advise putting this onto a piece of cloth rag and wiping it over the snake, avoiding the head area. The spray can also be used in the snake's environment, but the enclosure and any other objects must be completely dry before the reptile is placed back in its quarters.

Thermal burns in snakes

These are entirely preventable, but sadly still quite common, especially in snakes kept by novices. The last snake I had in with severe burns was an adult female ball (royal) python that somebody had rescued from some youths that were playing with it out on the street. He had not planned to get a snake, but had done some research. He had bought a heat mat, which sadly was not connected to a thermostat, and had placed this inside the vivarium underneath a ceramic tile.

The tile, as you can imagine, got extremely hot, to the point that it formed a hot plate within the vivarium, similar to the sort of set-up that you would use for cooking things! Snakes do not seem to have the ability to realise that a surface is too hot quickly enough, in time to avoid



▲ A badly designed set-up can lead to snakes getting badly burnt, even close to their floor of their quarters.

getting badly burnt. This particular individual had severe burns ventrally, on the underside of its body, as a result. It ended up having to be euthanised, partly on welfare grounds, and also for financial reasons.

▼ Experienced reptile veterinary nurse David Stokes demonstrates using a piece of cloth to apply Frontline spray.



Painkillers matter

When it comes to treating burns in snakes, most people realise that antibiotics are necessary, as severe burns almost always become infected, but



what is often forgotten is the need for appropriate painkilling treatment or analgesia. It is difficult to “pain score” a ball python, which is fairly stoical creature at the best of times, but just because it is not outwardly showing obvious signs, this does not mean that it is not feeling severe pain. We know ourselves that burns can be very painful.

A particular difficulty, however, is providing adequate pain relief for a prolonged period of time. Severe burns in snakes will often take as long as six months to contract fully and be replaced with scar tissue. There is little scientific literature at present about using pain relief agents in reptiles, as only a limited number of species have been studied as far as providing pain relief is concerned.

The limited information that we have available suggests that morphine, for example, may not be a particularly effective analgesic agent in corn snakes. This is interesting, because without knowing this, my first choice of an analgesic drug for a very badly burnt snake would probably be morphine.

I feel it is vital to look at the available literature and extrapolate to find the best analgesic agent that can be provided to the species of reptile concerned. But I have also heard of several similar cases in snakes involving burns where no pain relief was ever provided. This to my mind is not acceptable. An initial period with opioid pain relief and subsequent



Arboreal snakes are at greatest risk of suffering burns, if they get close to heat sources in the vivarium. Suitable safe screening is essential for their well-being.

treatment with a non-steroidal anti-inflammatory drug is currently my preferred pain relief protocol for reptiles that are suffering burns.

Topical agents are very useful for burns in reptiles; my preferred agent being Flamazine™ cream (silver sulfadiazine), which is a treatment used for human burns victims. It is very broad spectrum in its action and is also effective against *Pseudomonas* bacteria that are commonly present on the skin of reptiles and are frequently resistant to many antibiotics commonly used in veterinary medicine. Fluid therapy for a period of time is also usually given as standard. Hopefully, by making the snake as comfortable as possible, so this will aid its recovery.

Substrate impactions in lizards

I still see substrate impactions time and time again in lizards. I often wonder why impactions in bearded dragons happen with such frequency outside of my own circle of reptile keeping friends, who all maintain bearded dragons on sand and have done so for years, not having a problem. I know people that have kept and bred many hundreds of beardies and kept them on sand and never had a suspected or detected problem with substrate impaction.

I feel that the issue needs to be considered in more detail than simply following the blanket “using sand for bearded dragons is wrong” type of statement as you see in some care sheets. In fact, this is potentially harmful itself, because it has encouraged widespread use of what to my mind are entirely inappropriate substrates. Using newspaper for bearded dragons in my opinion is inadequate for the following reasons:

1: It is totally non-absorbent and the animals are able to walk through their own faeces. It also allows for live food to feed on faeces, which is not ideal from a hygiene point of view.

2: It retains no heat at night. For a species such as a bearded dragon which is provided with no supplemental heat at night, this is not appropriate. In Australia, the surfaces there retain heat for a period after the sun goes down and I feel that it is important to recreate this in the vivarium setting for the health of the lizards.

3: It is not enriching for the lizards. Bearded dragons dig when provided with sand, and not just when they are laying eggs. I do not keep bearded dragons anymore, but when I did, they would dig themselves a little shallow “burrow” underneath a rock or piece of



This bearded dragon had obvious sand visible in its gut when it was being X-rayed for other reasons. The sand was not causing any problems, and this X-ray demonstrates how bearded dragons normally eat a small amount of sand.



▲ Sand is the substrate that bearded dragons often occur on in the wild, as shown here.

▼ Lack of adequate supplementation of live food may be significant in cases of impaction.

bark every night. I feel this is necessary for their own psychological well-being, appearing to be an instinctive behaviour. As I have mentioned in previous articles, I have seen bearded dragons that have worn their toes raw through trying to dig through a solid wooden floor covered only by a thin sheet of newspaper.

Potential causes isolated

The fundamental question remains - why do some people have problems with impaction in their bearded dragons and others don't? Based on my experience, there are a few reasons. Firstly, some people have persistently reported that sand ingestion occurs when the beardies are not provided with adequate calcium in their diet.

I think there must be some element of truth in this, although I do not have any scientific evidence to back it up. In my experience, owners who provide a combined UV heat lamp, plus an Arcadia T5 UV tube for two-thirds of the vivarium at an appropriate height with the remaining third of the vivarium being left without any artificial lighting, plus plenty of hiding places seldom have bearded dragons with impactions.

On the other hand, I find that most of the cases presented with impactions seem to occur in lizards that are kept

with a suboptimal compact lamp, or an Asian-made UV tube (I am convinced that these particular tubes do not compare favourably with many of the other brands on the market). Furthermore, the lamp is usually suspended far too high in the vivarium, with no reflector being used either.

Owners that have the problems with impactions are also often those clients who do not gut load their feeder insects appropriately, or feed their bearded

dragons predominantly on mealworms. They also tend to be people who have some calcium powder to supplement their lizard's food with, although they aren't aware of the brand and certainly don't use it as regularly as they should! I feel there must therefore be a husbandry element that predisposes bearded dragons to ingesting their substrate.

I think that the type of substrate used has a huge impact on the likelihood of a lizard becoming impacted. In general, a "crushed bricks" or "grit" type substrate will result in more impactions than children's play sand or real desert sand (such as desert sand sold by Exo Terra which is from the Namib desert). A degree of sand ingestion will inevitably happen when bearded dragons are housed on sand, and the consistency of the grains being swallowed has a tremendous impact on if



Chameleons can become impacted as the result of inadvertently consuming vivarium décor.



it is likely to cause a problem, or whether it will simply come out in the faeces in my experience.

Dealing with the issue

In terms of my approach to impaction cases, or cases where I suspect there is an impaction. I usually ultrasound female lizards first, because follicular stasis (affecting the reproductive tract) and substrate impactions can present in a similar way and you will not always feel

an impaction by palpating the belly with your fingers.

Ultrasound will confirm or rule out follicular stasis, and also will often give you a good idea if there is a foreign body, because foreign bodies tend to produce a characteristic bright white shape on ultrasound (being known as hyperechoic) with a large amount of shadowing. I then often proceed to X-ray to confirm the cause and severity of the problem.

If a foreign body is confirmed, then depending on how it looks, medical treatment can be started in the form of cathartics to try and flush the substrate though in the case of some sand impactions for example. Obviously if there is a large piece of bark or something else wedged in the stomach, then no amount of lubrication is going to facilitate its expulsion. Therefore in many cases, it is necessary to go in surgically and try to remove the cause of the impaction.

▼ This pair of X-rays demonstrates why two views always need to be taken. You can just about see the sand impaction on the full body view, with the bearded dragon lying on its back, but it is very clear from the side. This animal did well following treatment with cathartics (treatment that speeds up passage through the gut), and did not require surgery. Photos courtesy of the author.



Chameleons and foreign bodies

As a final point, I would be very careful using fake plants with chameleons. I have seen several cases now where chameleons have died and on post-mortem examination, I have found a large fake leaf in the stomach. There has been a lot of publicity about not using silk plants for this very reason, but I find plastic plants commonly have thin vinyl leaves that are also often ingested. It is not a problem where the leaves are made from hard plastic.

The aim of this article has been to discuss a few key points that I have found relating to what are, sadly, common conditions, hopefully focusing on how to prevent them. It goes without saying that if you are concerned about any of the ailments that I have discussed in this article, it is worth booking a consultation with your exotics veterinary surgeon. ❖

Further information

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Puzzle Corner

Find the solutions to these puzzles by following the clues, to discover which reptiles, amphibians or invertebrates are hidden within them. The answers can be found on p66.

COUPLETS

Select two consecutive letters from the three boxes on each line of the grid to form a six-letter word in the stars alongside. INDOOR will give you one of them and a correct solution will reveal the common names of two rat snake species running down the lightly shaded stars.

HEMP	BRIM	MAYO
CHUG	HALP	DIET
TRAY	RIFT	POLE
ABUT	URGE	LEAF
PAIN	DOME	MOOR
EDIT	SOUP	LAWN



LINKAGE

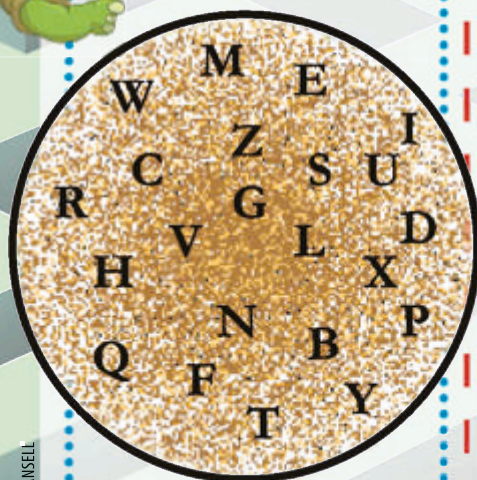
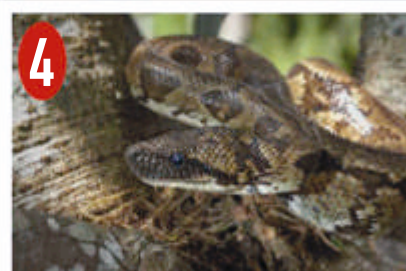
Can you recognise these two reptiles and figure out what links them to a more widely-kept pet?



Gone Missing

WHERE IN THE WORLD?

On which island are these four species to be found, and what are they?



Pick out and rearrange those letters of the alphabet missing from the circle above to spell out the name of a *Lion King* python.

Herpetological Mysteries

LIVING DINOSAURS IN AFRICA?



SEEKING THE MOKÈLÉ-MBÈMBÉ

In the first of a three part series, Dr Karl Shuker investigates as to whether there could be unidentified reptilian survivors from the age of the dinosaurs still surviving in parts of Africa.

For many years, the most famous cryptozoological creatures – those which may exist but which have yet to be formally recognised by science – were the Loch Ness monster, the yeti, a sundry array of sea serpents, and the North American bigfoot or sasquatch. This situation changed dramatically, however, in 1982.

Focus on the Congo

Following his return to the USA in the December of the previous year, after the second of two expeditions to the People's Republic of the Congo (formerly the French Congo), veteran American cryptozoologist Prof. Roy P. Mackal made an astounding

announcement. He revealed to an amazed media and general public that the elusive swamp monster he had been searching for in that region of Africa could conceivably, in his opinion, turn out to be a living dinosaur!

A new cryptozoological star had been born – an elusive long-necked

mystery beast that bore an extraordinary outward resemblance to a sauropod (*Diplodocus*-like) dinosaur and was known to the local Congolese pygmies as the *mokèlè-mbèmbé*. Since then, numerous expeditions in search of this and other potential prehistoric reptilian survivors from the age of the

➤ Judging from eyewitness descriptions, there is a great similarity in appearance between the *mokèlè-mbèmbé*, seen here alongside hippos, and certain dinosaurs.

Artwork courtesy William Rebsamen.





Different variants of the same creature are known to exist in Africa today. This is a forest elephant for example – so could it prove to be the same with neodinosaurs?

dinosaurs have been launched in various parts of tropical Africa. These have uncovered all manner of fascinating and tantalising crypto-clues, as will be revealed in this series of articles.

A number of neodinosaurs?

Judging from eyewitness accounts, there are a number of very different mystery beasts on file that seem to resemble various familiar types of dinosaur known currently just from the fossil record. Whether any actually are dinosaurs, of course – thereby sensationally resurrecting prehistory's most spectacular reptilian lineages from at least 64 million years of official extinction - has yet to be determined.

Nevertheless, because they are so commonly aligned with them in the cryptozoological literature, the term

'neodinosaur' is often given to these dinosaurian lookalikes. And the most famous of all neodinosaurs is still the mokélé-mbembé.

Earliest accounts

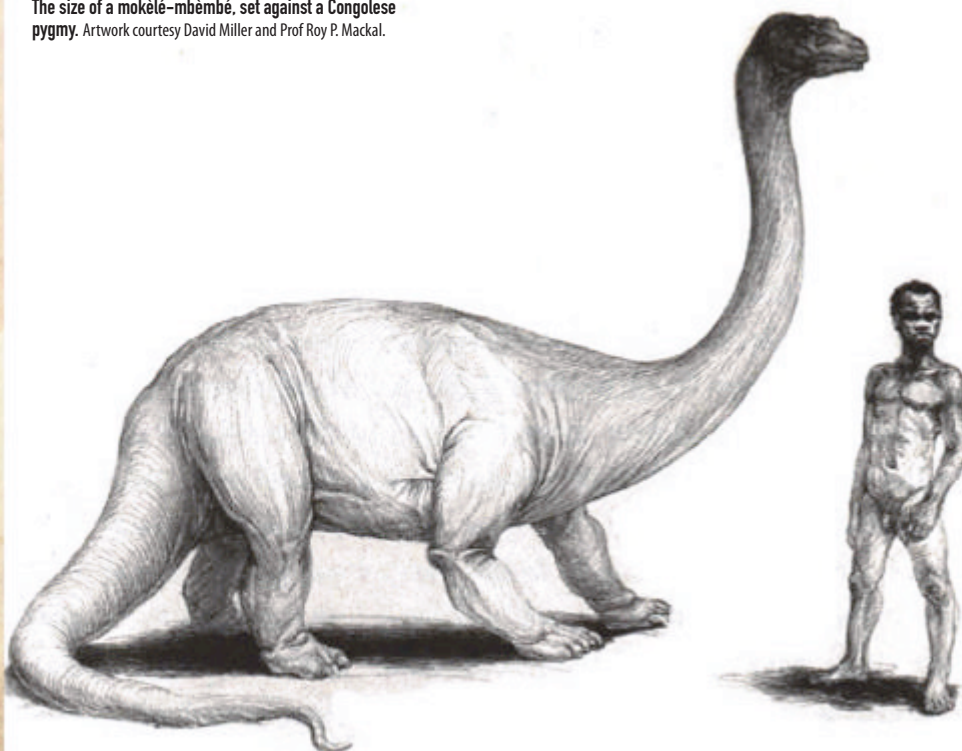
This mysterious creature has a surprisingly lengthy history. Vague, unspecific reports of giant water dragons in parts of western and central Africa date back at least as far as 1776. The earliest documented report is of a series of monstrous three-clawed footprints, roughly 1m (3ft) in diameter, which were observed in the Gabon-Congo area by a French missionary called Abbé Lievain Bonaventure Proyard.

It was in 1913, however, that the mokélé-mbembé (which literally translates as 'blocker of rivers') was specifically mentioned for the first



▲ Modern interest in African neodinosaurs dates back to a crocodile study that took place during the mid-1970s in Gabon.

The size of a mokélé-mbembé, set against a Congolese pygmy. Artwork courtesy David Miller and Prof Roy P. Mackal.



time, by name, in an official German government report by a Captain Freiherr von Stein zu Lausnitz. This featured as part of the written documentary record of the Likouala-Congo expedition of that year, in which he had participated. The captain noted the information obtained from the Congolese pygmies revealing that the mokélé-mbembé is: ".... said to be of a brownish-grey colour with a smooth skin, its size approximately that of an elephant, at least that of a hippopotamus. It is said to have a long and very flexible neck... A few spoke about a long muscular tail like that of an alligator. Canoes coming near it are said to be doomed; the animal is said to attack vessels and to kill the crews but without eating the bodies."

Nevertheless, this intriguing report attracted little attention until many years later. Even in his pioneering cryptozoological tome entitled *On the Track of Unknown Animals* (1958), Dr Bernard Heuvelmans did not accord

➤ Mackal and Powell headed to Likouala, a remote region in the northeast of the People's Republic of the Congo.

A precedent for the mokèlé-mbèmbé?

At the start of the 20th century, it was confirmed that what is now known to be a member of the giraffe family had remained hidden in the Ituri forest of the Congo, away from European eyes, although its existence was common knowledge to the pygmies who share its habitat.

This mysterious beast was formally named as the okapi (*Okapia johnstoni*) in 1901. On this basis, might it not be possible that a large, essentially aquatic water creature could also exist in this part of the world, presently unrecognised by science, in the guise of the mokèlé-mbèmbé?



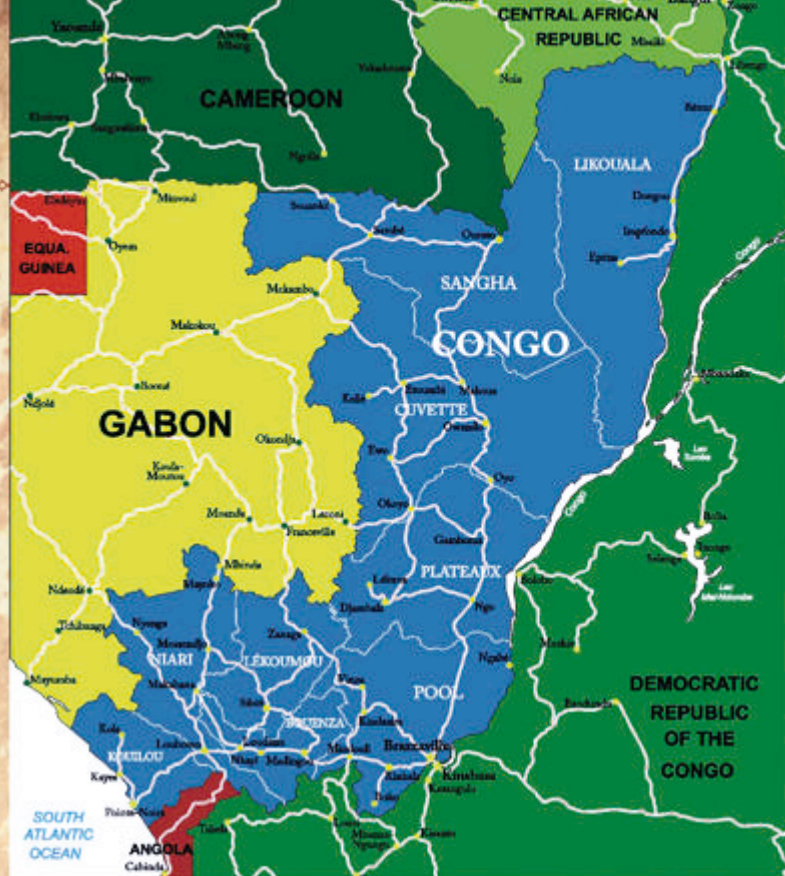
the mokèlé-mbèmbé any greater coverage or significance than a host of other tropical African water monsters with strange names also documented by him in what has become one of the classic cryptozoological books.

Growing interest

In fact, it was not until the mid-1970s that this mystifying swamp-dweller finally begins to emerge from the shadows of cryptozoological obscurity. This was thanks to an expedition not to the Congo but rather to neighbouring Gabon, by American herpetologist James Powell.

While visiting this country in 1976 and 1979 to study crocodiles, Powell was very surprised to learn from the local Fang Bantu tribe of a huge water beast fervently believed in by them, which they termed the *n'yamala*. Asked by Powell to describe it, they proffered a verbal portrait corresponding precisely with that of the Congolese mokèlé-mbèmbé.

➤ Left-right: James Powell, with a camp guide and Prof Roy Mackal in search of the mokèlé-mbèmbé. Photo courtesy Prof Roy Mackal.



Obtaining answers

When Powell then showed the tribespeople a selection of pictures of living and extinct animals, the image that they consistently chose as representing the closest match with the *n'yamala* was that of a *Diplodocus* dinosaur. Moreover, testing their honesty as to which creatures lived in their region, Powell deliberately showed them, amid pictures of known local beasts (which they readily recognised), some images of bears and camels,

which definitely do not exist in or around Gabon.

Sure enough, the Fang people stated that they had never seen these alien animals, and that they did not live in the area. This confirmation of their truthfulness concerning those that did exist locally gave Powell confidence in accepting their testimony concerning the *n'yamala*.

Expeditions launched

His conversations with the Fang tribe led to Powell teaming up with Prof.





▲ The mokélé-mbembé is said to be three-toed.

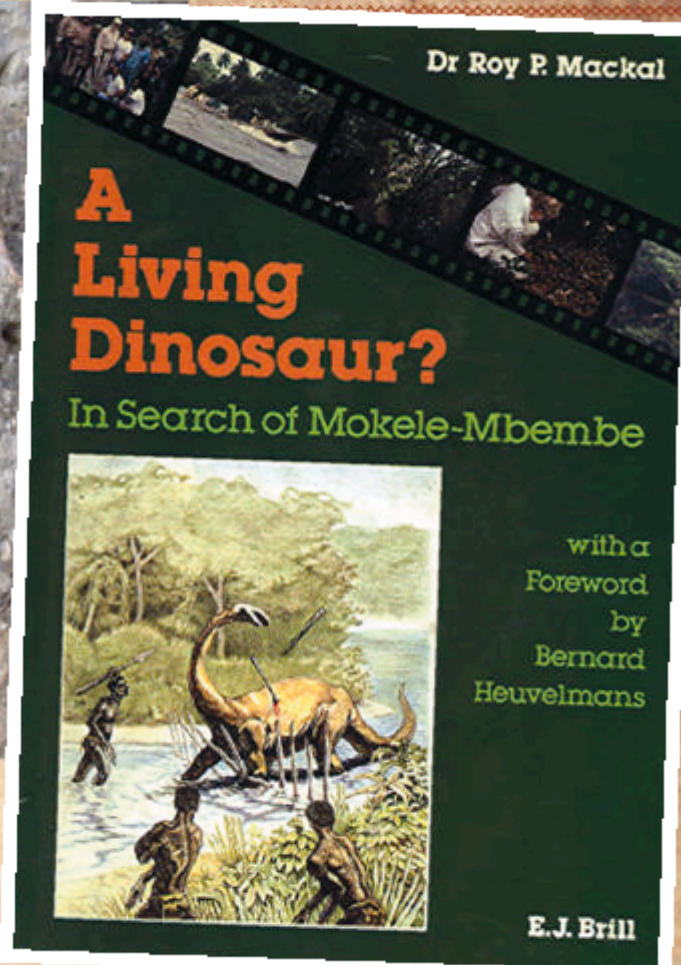
Roy P. Mackal, not yet retired from his academic position as a zoologist and biochemist at Chicago University in the USA. Together, in 1980, they duly launched the first of two expeditions led by Mackal to the vast Likouala swamplands in the scarcely explored northern region of the People's Republic of the Congo.

Here they hoped to discover the n'yamala's Congolese counterpart, in the guise of the mokélé-mbembé. A year later, Mackal returned there with a second expedition, and the data gathered during these searches, which Mackal described in detail in his fascinating book entitled *A Living Dinosaur? In Search of Mokélé-mbembé*, published in 1987, laid the groundwork for all future African neodinosaur quests.

New information

Although he and his colleagues never saw a mokélé-mbembé themselves, Mackal's information based on reports of this cryptid creature, as elicited from the local Likouala people and Kabonga pygmies, was very extensive. They not only fully collaborated but also considerably expanded upon the information that had been contained in the 1913 German government report.

Asking eyewitnesses to describe the mokélé-mbembé verbally and via drawings in the sand *before* showing them any images of creatures (thereby avoiding any chance of influencing their accounts), Mackal and his colleagues determined that this mystery beast does indeed



▲ Prof Roy Mackal's book describing his expeditions to the Congo in search of the mokélé-mbembé generated a lot of interest.

▼ The mokélé-mbembé is said to spend the majority of its time submerged and out of sight, but it does feed on plant matter along the banks of the waters where it occurs.

Artwork courtesy David Miller and Prof Roy Mackal.

closely resemble a small (i.e. elephant-sized) sauropod dinosaur.

Determining its appearance

It is described as having a basic *Apatosaurus* (*Brontosaurus*) or *Diplodocus* shape. This means that it is characterised by a long neck, small head, four sturdy limbs and clawed feet that leave behind characteristic three-toed footprints (examples of which were witnessed and recorded by Mackal's team), with a long tapering tail.

It spends much of its time submerged in deep riverside pools and small lakes, with only its head and neck spasmodically emerging above the water surface to browse upon the bankside vegetation. However, it is occasionally seen on land, mostly during the early morning or late afternoon.

One notable eyewitness account collected by the team was that of a local hunter called Nicolas Mondongo. The encounter happened on one sunny morning during the 1960s, while he was standing on the bank of the Likouala-aux-Herbes River upstream of Mokengi village.

Mondongo observed a mokélé-mbembé rise up fully out of the water, which cascaded down from its shoulders as it stood there for a full three minutes, totally exposed and little more than 14m (46ft) away from



the terrified Mondonga, before it abruptly submerged again. Mondonga estimated its total length to have been roughly 9m (30ft).

Feeding preferences

The mokélé-mbèmbé is exclusively vegetarian, and exhibits a pronounced dietary preference for an indigenous fruit known to local people as the *malombo*, which proved to be from a species of *Landolphia* gourd. Nevertheless, in common with certain other large vegetarian species, such as elephants and Cape buffaloes, its size and strength means that it can be very aggressive if confronted - overturning canoes, killing (but not eating) the vessels' defenceless occupants with powerful thrashes of its tail, and even invading the pygmies' camps.

In addition to being greatly feared, people living in the area consider the mokélé-mbèmbé to be as real as any other animal species inhabiting this region. Indeed, they were surprised that the Western explorers were not familiar with it.

A mokélé-mbèmbé captured

One of the most extraordinary claims made by locals interviewed by Mackal's team came from a tribe of pygmies who live near a large shallow Likouala lake called Tele, where mokélé-mbèmbés are often said to appear. Back in 1959, according to these pygmies, they had actually captured and killed a mokélé-mbèmbé there.

They stated that they had cordoned off part of the lake for fishing, by

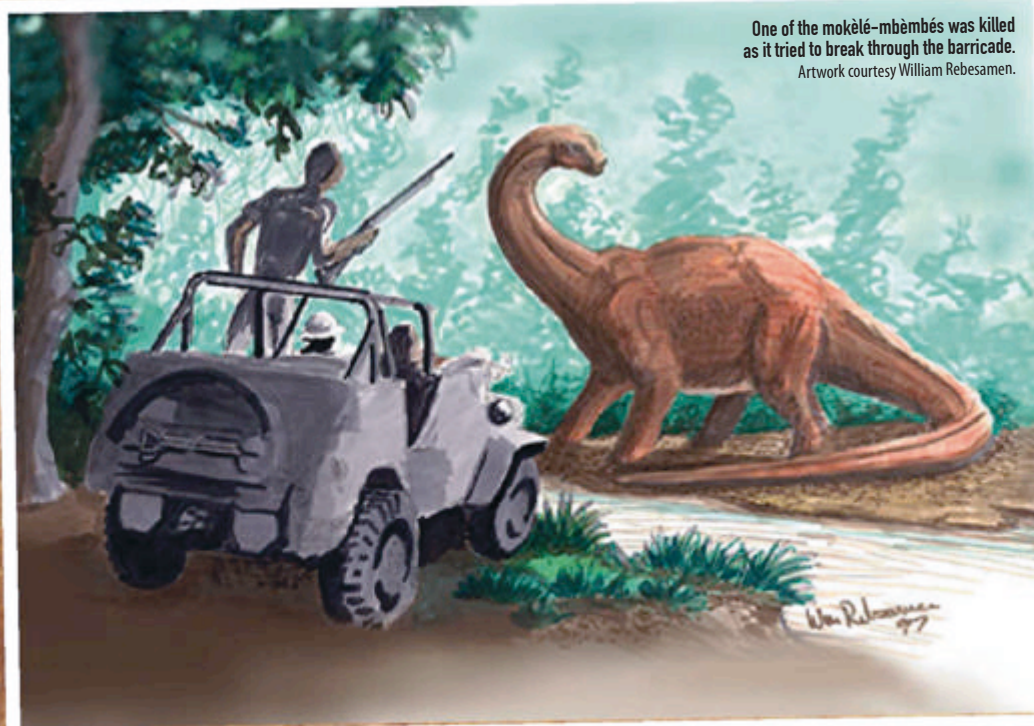
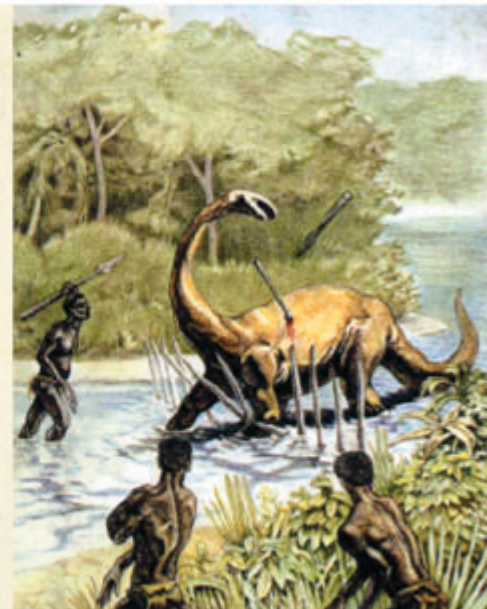
building and erecting a high wooden barricade, specifically to deter mokélé-mbèmbés. However, two mokélé-mbèmbés attempted to force their way through the barricade, which resulted in the pygmies spearing one of these creatures to death.

Afterwards, some of them feasted upon its flesh, but everyone who ate it died shortly afterwards. Not surprisingly, therefore, those that had not partaken of the meat and had thus survived wasted no time in discarding what was left of the creature's carcass. This was also a tragedy for modern science, however, because it deprived any scientist of a unique opportunity to examine the physical remains from one of these creatures that might otherwise have

➤ Although the mokélé-mbèmbé was killed, its flesh proved deadly when eaten, and its body was discarded. Artwork courtesy Prof Roy Mackal.



The mokélé-mbèmbé is considered very dangerous in the locality where it occurs. Artwork courtesy Richard Svensson.



One of the mokélé-mbèmbés was killed as it tried to break through the barricade. Artwork courtesy William Rebesamen.

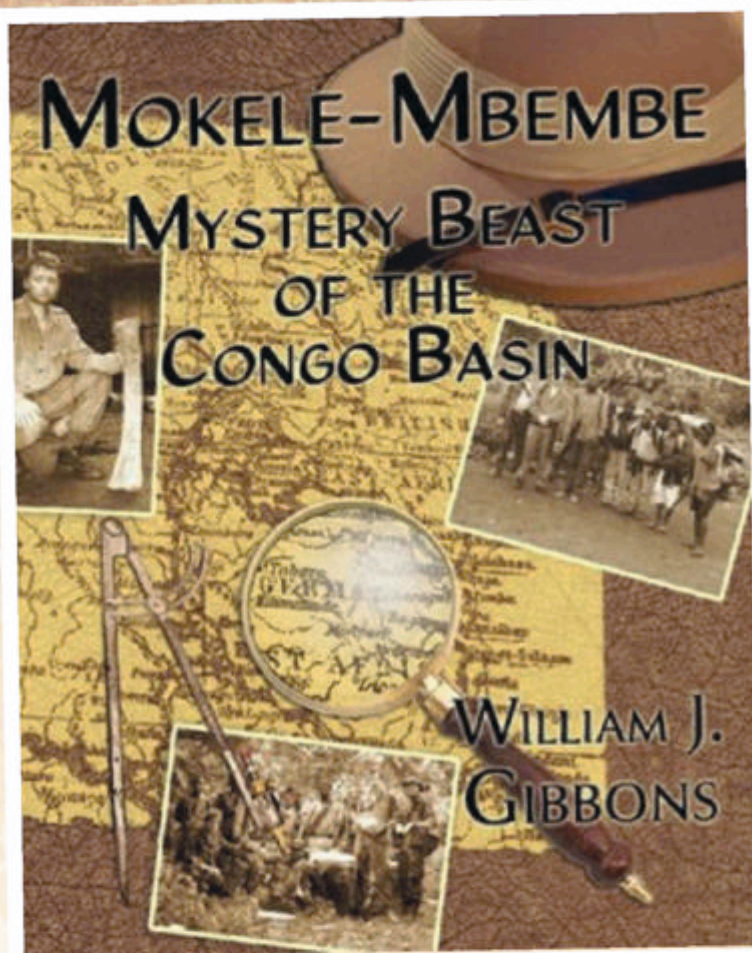
been retained.

British-led expeditions

Inevitably, once news of Mackal's findings was publicised, a veritable phalanx of mokélé-mbèmbé expeditions travelled to the Congo in search of this enigmatic neodinosaur, calling to mind scenes from the film *Jurassic Park*. British scientific endeavour was well-represented by two Operation Congo expeditions, both led by Scottish-born explorer Bill Gibbons.

These took place in 1986 and 1992 respectively. Sadly, the team was beset by bureaucratic problems, which severely hampered its attempts to pursue its long-necked quarry in the area of Likouala. Once again on both occasions, however, the group nevertheless collected a sizeable archive of reports and eyewitness accounts.

Close to the village of Dzeke, moreover, team members were taken by a retired elephant hunter called



▲ Expeditions by those such as Bill Gibbons have added to the recorded information about mokèlé-mbèmbé, but tangible evidence of the creature's existence has remained elusive.
Artwork course William Rebsamen.

◀ Bill Gibbons has written about his quest to find the mokèlé-mbèmbé.

the lake, with only their trunks curved up above the water surface!

A much larger British expedition of ten people, organised by children's television presenter Tommy Boyd and led by explorer Barry Marshall, took place during February 1993. They hoped to find some evidence for Cameroon's supposed counterpart to the mokèlé-mbèmbé. However, no evidence for its existence or even any positive responses from native tribes there were reported on this occasion.

Emmanuel Mougoumela to a wooded area near the river. Here they saw the trail of alleged mokèlé-mbèmbé footprints first documented several years earlier by Mackal and company during their second expedition.

Of particular note is the fact that Gibbons collected considerable first-hand information and sightings from various French missionaries who had spent many years in this region, and for whom the mokèlé-mbèmbé was an absolute reality. In short, testimony for its existence extended beyond that of native sources, to include Western-born eyewitnesses too.

Further investigations

Prof Mackal was never able to raise sufficient money for a third expedition to the area. Nevertheless, other

well-publicised, post-Mackal expeditions have included two Japanese expeditions during the 1980s, although neither made any notable findings. Then there was a solo quest to Lake Tele in 1986 by American journalist Rory Nugent. He snapped some blurry photos of an unidentifiable periscope-like object visible above the lake surface, but ultimately, these were inconclusive.

A two-man expedition to this same lake took place over the course of four months in 1989, headed by British traveller-writer Redmond O'Hanlon. He concluded that mokèlé-mbèmbé reports were based upon submerged elephants crossing



▲ A Baka tribesperson's drawing, purporting to show the appearance of the li'lela-hembe, obtained in 2009.
Photo courtesy Robert Mullin.

Into the new millennium

Expeditions have continued during the present century. There was the Dino2000 expedition to Lake Tele in November 2000. It featured the British explorer Adam Davies, and although he obtained plenty of video footage, there were no sightings of mokèlé-mbèmbé.

Also in November 2000, Bill Gibbons returned to Africa, in the company of American businessman David Woetzel. They journeyed to Cameroon, where they penetrated the hitherto-unexplored forest and swamps along the Boumba and Laponji Rivers.



The suggestion that reports of the mokèlé-mbèmbé are actually based on swimming elephants seems unlikely, although this explanation has been suggested.

In this region, they gathered numerous accounts from the Baka pygmies concerning their mokèlé-mbèmbé, which is known as the li'kela-bembe. During the following year, Gibbons returned to Cameroon, as part of the CryptoSafari expedition featuring fellow cryptozoological researchers Scott Norman and John Kirk, and added further details to their neodinosaur dossier, but definitive evidence of the existence of such creatures remained elusive.

Sonar evidence?

In 2006, a National Geographic expedition led by Brady Barr trekked out to Lake Tele, but no mokèlé-mbèmbé sightings were recorded. In 2009, Bill Gibbons revisited Cameroon with a fresh team, as part of the cryptozoology-based television series *Monster Quest*, but again, no sightings occurred. However, they did obtain sonar readings of very long, unidentified serpentine shapes underwater.

During 2011, another cryptozoological television series, *Beast Hunter*, sent an expedition to the Congo Basin. Unfortunately, no findings of significance were made on this occasion either, but there is, largely thanks to the earlier expeditions of Prof Roy Mackal, a wealth of evidence surrounding the likely appearance and lifestyle of the mokèlé-mbèmbé, obtained from a wide variety of different sources.



▲ The mokèlé-mbèmbé is reputedly primarily aquatic, which could explain the sonar readings. It is said to use its long neck to browse on fruit and vegetation. Artwork courtesy William Rebsamen.

Fact and fiction

The problem is in part that these creatures, assuming they do exist, live in a very inaccessible area of the world. The terrain itself is hostile, and this makes moving around very difficult. Furthermore, the mokèlé-mbèmbé is essentially aquatic by nature, and reputedly rare as well, which makes it exceedingly hard to spot, without being very lucky.

Nevertheless, cryptozoologists are undeterred, and the search continues. Even Hollywood has shown an interest in the mokèlé-mbèmbé, resulting in

the 1985 Touchstone film *Baby: Secret of the Lost Legend*. This concerned the discovery and temporary capture of a baby mokèlé-mbèmbé by an American palaeontologist. There can be no greater recognition afforded to this modern addition to the list of cryptozoological creatures that have captured the public's interest than being immortalised in a movie!

* Dr Karl Shuker BSc PhD FRES FZS is a zoologist, author and broadcaster who is pre-eminent in the field of cryptozoology – the study of animals whose existence is not proven.

Next month: Assuming that the mokèlé-mbèmbé is real (and not merely a native legend), what could it be? Several very different identities have been put forward, as will be revealed next month in the second part of this article.



▲ Travelling through the area of Africa where the mokèlé-mbèmbé is said to occur is very difficult. There are no short cuts through dense tropical forest!

Discover more about such mysteries

Karl's book, entitled *Dragons in Zoology, Cryptozoology, and Culture*, is published by Coachwhip Publications (978-1616462154), and extends to 220 pages. It can be purchased from bookshops or online, and is priced at approximately £20.



YOU & YOUR Reptiles



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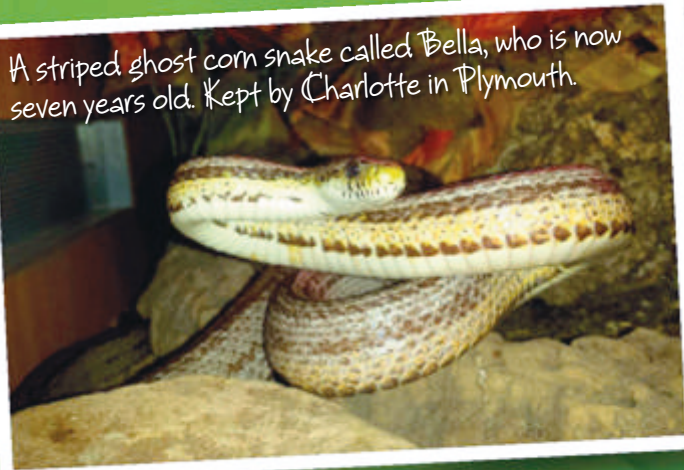
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Also, tell us where you live, because the best photograph, as judged by the *Practical Reptile Keeping* team, will win a prize. This month's winner will receive a personally signed copy of *The Arcadia Guide to Reptile and Amphibian Nutrition*, written by John Courteney-Smith. This ground-breaking 272 page colour book covers vitamin and mineral groups, uses and interactions; food categories; supplementation; gut flora and parasites; gut loading; livefood safety, nutrition and variety with 23 sources of livefood covered, plus much more!



Perry, a cheerful super snow leopard gecko.
From Ettore in London.

A striped ghost corn snake called Bella, who is now seven years old. Kept by Charlotte in Plymouth.



➤ An extremely rare slender toed gecko.
From John in West Sussex.



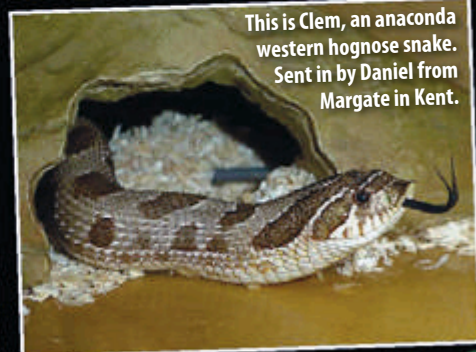
An Irian Jaya jaguar carpet python called Jessie.
From Dan.



Balou, the northern blue tongue skink. Sent in by Harry from Alton in Hampshire.



This is Clem, an anaconda western hognose snake.
Sent in by Daniel from Margate in Kent.

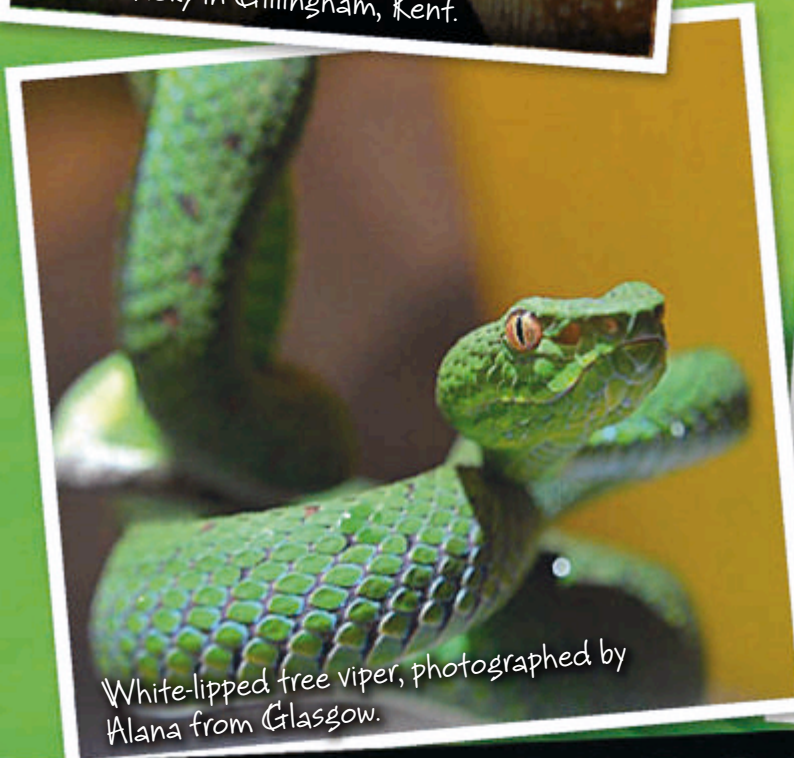




Thorn the bearded dragon, enjoying the sun outdoors, wearing her harness and leash. From Vicky in Gillingham, Kent.



A pancake slug chomping through a lettuce leaf. Sent in by Terry.



White-lipped tree viper, photographed by Alana from Glasgow.



Alfie the bearded dragon tucking into some food. From Daril in Essex.



Xena, a toffeebelly western hognose snake. From Daniel in Cliftonville, Kent.



Bill's mangrove snake. They live in Plymouth.



Mango the crested gecko. The much-loved pet of Adam, who is 8 years old, from Maldon in Essex.



Three baby bearded dragons. From Ettore in Catford, London.



Banjo the panther chameleon. Sent in by Charlie from Emsworth in Hampshire.



Bernie, a nine month old bearded dragon out in the sun. From Martin in Grimsby.



◀ An Ambilobe panther chameleon called Vai, with his food. From Pete in Peterborough.



A male sun beetle (*Pachnoda marginata peregrina*). From Terry in Horsham, West Sussex.



▲ A crested gecko called Gizmo, resting on his favourite log. From Gaz in Wrexham.



A holiday photograph of a wild alligator encountered in Florida. From Luke in Towcester, Northamptonshire.



A Madagascar plated lizard - the latest recruit to Arcadia's team!

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LINKAGE: THE COMMON NAME OF BOTH SPECIES INCLUDES A REFERENCE TO CATS. THEY ARE AS FOLLOWS: 1. NORTHERN CAT-EYED SNAKE (*LEPTODEIRA SEPTENTRIONALIS*). 2. CAT-EYED GECKO (*AEUROSCALAROTES FELINUS*).

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GONE MISSING: JOKA

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2. MADAGASCAN HISSING COCKROACH (*GROMPHADORHINA PORTENTOSA*).
3. ANGONOKA OR PLOUGHSHARE TORTOISE (*ASTROCHELYS YNIPHORA*).
4. MALAGASY OR MADAGASCAR TREE BOA (*SANZINIA MANDITRA*).



In the August **Practical Reptile Keeping** issue

NEW TECHNIQUES FOR FROGS

A different approach to keeping the *Rhacophorus* or 'cave-dwelling' frogs is revealed by Mikhail Bagaturov in his article about breeding these amphibians successfully.



REPTILES IN ART

There's a growing interest in art involving reptiles, but what are the themes, and where can you start if you want to begin a collection?



STAY SAFE!

Don't miss our exclusive interview with professional snake catcher Simon Keys, who with his wife Nadine stars in the National Geo television series, *Snakes in the City*. Together, they battle to keep Durban's homes free from deadly snakes, moving them to more suitable surroundings.



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*These are just some of the features planned for the next issue but circumstances outside our control may force last-minute changes. If this happens, we will substitute items of equal or greater interest.

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Natural Control of Intestinal Hygiene



HEALTHY REPTILES HAPPY YOU.



NEW!

Are you concerned about using pharmaceuticals?

Feeding **Verm-X** to your Reptiles is the natural and organic way to improve intestinal hygiene by providing daily protection keeping your Reptiles healthy and you happy.

Award winning **Verm-X** consists of a recipe of herbs that have been used for centuries as a natural way to control intestinal hygiene in many species. The 10 chosen herbs have the additional benefits that support all-round health.

Recommended by vets **Verm-X**® for Reptiles is produced as a powdered formulation, ideal for 'dusting' and is fed for 3 consecutive days each month easily sticking to insects and forage.



Available from all pet and specialist suppliers.



NO ARTIFICIAL CHEMICALS

Apply by dusting lightly onto any feed e.g. **Verm-X** sticks well to insects and vegetation.

“Having such a powerful and effective product containing only herbs for supporting the intestines during periods of challenge and that promotes health is a revelation.

Recommended by Vets

See Vet Nick Thompson's talk on herbs [New YouTube](#)



Verm-X®

Natural Control of Intestinal Hygiene

100% Natural

An effective formulation for supporting intestinal health during periods of challenge

Available from your local pet and country retailer or online



Equine



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Avian

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